



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 19, 2019

Factual Report

OPERATIONAL FACTORS/HUMAN PERFORMANCE

DCA19MA086

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A. ACCIDENT

Location: Trinity Bay, Texas
Date: February 23, 2019
Operator: Atlas Air Flight #3591 (heavy)
Time: 1239 Central Standard Time (1839Z GMT)¹
Registration: N1217A

B. OPERATIONAL FACTORS/HUMAN PERFORMANCE GROUP

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C. SUMMARY

On February 23, 2019, at 1239 central standard time, Atlas Air flight 3591, a Boeing 767-375BCF, N1217A, entered a rapid descent from 6,000 ft and impacted a marshy bay area about 34 miles southeast of George Bush Intercontinental Airport (IAH), Houston, Texas. The two pilots and one non-revenue jumpseat pilot were fatally injured. The airplane was destroyed and highly fragmented. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 121 domestic cargo flight, which originated from Miami International Airport (MIA), Miami, Florida, and was destined for IAH.

D. DETAILS OF THE INVESTIGATION

On February 24, 2019, the NTSB Operational Factors (Ops) Group launched to the accident site and attended the NTSB organizational meeting in Anahuac, Texas where the Ops Group was subsequently formed for the investigation.² FAA Blue Ribbon packages for both Atlas Air pilots and Mesa Air jumpseater, along with FAA data on all three pilots and Atlas Air files for both Atlas Air pilots were requested. Pilot training, scheduling and employment information were requested from Atlas Air and Mesa Airlines. Atlas Air B-767 manuals were received, and background

¹ All times in this Factual Report are Greenwich Mean Time (GMT), “Z,” unless otherwise noted.

² Reference Attachment 33 - Party Forms.

checks on all three pilots were requested. In addition, cargo loader statements were requested from StratAir.³

On February 25, 2019, the Ops Group chairman reviewed an Atlas Air B-767 simulator at the Boeing facility at MIA, and then met with the NTSB Human Performance investigator and conducted an in-brief with Atlas Air senior management (VP Safety, Directors of Operations for Atlas and Polar, B-767 Fleet Captain, Senior VP of Flight Ops, VP Safety, and Senior Director SRC). Flight crew records were reviewed, and additional documentation was received from Atlas Air. Subpoenas for cell phone records were issued, and requests for statements from American and United pilots operating in the vicinity of the accident were made.

On February 26, 2019, the Ops Group conducted interviews of the Captain and First Officer (FO) that flew the accident airplane from Ontario International Airport (ONT) to MIA, preceding the accident flight, and a Captain and FO who most recently flew with the accident Captain and FO. Additional data requests were made to the FAA, Boeing and Atlas Air, and security camera footage was requested and subsequently subpoenaed from DHL and Dade County.⁴

On February 27, 2019, the Ops Group toured the Cargo City hanger facilities at MIA and documented an exemplar Atlas Air B-767. The Ops Group then interviewed the accident flight dispatcher, an Atlas Air FO with familiarity with the jumpseater, and the Loadmaster and Load Verifier for the accident flight.

On February 28, 2019, the Ops Group interviewed pilots of Atlas Air flight 3154 from November 2, 2018 who operated the accident airplane, one of whom reported an inflight pitch anomaly with the airplane on departure. Field notes were then developed, and that portion of the on-scene investigation was completed.

From May 1, 2019 to May 4, 2019, members of the Ops Group traveled to Seattle, Washington to participate in Boeing, FAA and NTSB Sequence of Events (SOE) investigative work.

From June 3, 2019 to June 6, 2019, the Ops Group conducted additional Atlas Air interviews in MIA, and conducted a B-767 simulator observation at the Atlas Air Training Center in MIA.⁵

On September 11, 2019, the Ops Group conducted interviews with FAA experts on pilot hiring and employment requirements.

³ StratAir (previously Strategic Air Services) was a company owned by SaltChuk in Seattle Washington that provided ground and cargo services at MIA.

⁴ See Attachment 34 – Subpoenas.

⁵ See Attachment 31 - MIA B-767 Simulator Observation.

E. FACTUAL INFORMATION

1.0 History of Flight⁶

On February 23, 2019, Atlas Air Flight 3591 (GTI3591) was operating for Amazon Air (formerly known as Amazon Prime Air).⁷ The accident airplane (N1217A) arrived into MIA from ONT at 1441Z (0941 EST) on February 23, 2019. The accident flight crew had previously been on duty 6 hours and 24 minutes on February 22, 2019 (the day before the accident), having arrived into MIA at 1351Z on a 4 hour 29 minute flight from ONT and were released to rest at 1421Z. They completed 24 hours and 17 minutes of rest before the scheduled report time of 1438Z for their departure of GTI3591 at 1608Z on February 23, 2019. According to hotel van records, the flight crew left the Crowne Plaza Miami Airport at 1409Z (0909 EST) and arrived at the MIA Cargo City location where the accident airplane had been parked, and were escorted to the airplane by ground service personnel.⁸

The accident flight's filed routing was the WINCO2 departure to the WINCO intersection, then direct to the DOLIE intersection, Y280 to LEV (Leeville VORTAC navigational aid, Grand Isle, Louisiana), direct to the GIRLY intersection, NNCEE1 arrival into IAH.⁹ According to the airplane's ACARS¹⁰ information, a predeparture clearance (PDC) request was sent by GTI3591 and received at 1540Z. The flight was cleared via the WINCO2 departure to fly the tower assigned heading and maintain 5,000 feet, expect FL400¹¹ 10 minutes after departure.

About 1614Z, GTI3591 contacted MIA ground control for pushback and startup from the Cargo City W15B parking spot with MIA Automatic Terminal Information Service (ATIS)¹² information

⁶ Times included in the History of Flight were derived from information provided in the air traffic control (ATC) Aircraft Accident Package (19-002-I90, dated February 26, 2019), the Houston Intercontinental Terminal Radar Approach Control Facility (TRACON) full transcript received from the FAA (dated February 27, 2019), Aircraft Communications Addressing and Reporting System (ACARS) data, and flight data recorder (FDR) data from the accident flight, unless otherwise noted. For additional information, see the Air Traffic Control Group Chairman's Factual Report in the docket for this accident.

⁷ Seattle-based Amazon leased the Amazon Air fleet (formerly called Amazon Prime Air) from Atlas Air Worldwide Holdings Inc. and Air Transport Services Group. Amazon Air changed its name from Amazon Prime Air in 2017 to differentiate between Amazon's "Prime Air" drone delivery initiative, but the Prime Air livery on aircraft leased to Amazon Air, like that on the accident airplane, remained unchanged. Source: <https://www.bizjournals.com/seattle/news/2017/12/26/amazon-prime-air-cargo-jet-fleet-boeing-767.html>.

⁸ See Attachment 21 - Flight Crew 72-hour History Documents and Attachment 13 - Crew Schedules.

⁹ See Attachment 3 - Atlas Air Flight 3591 Flight Release.

¹⁰ ACARS is a digital data link system for transmitting short, relatively simple messages between aircraft and ground stations via VHF, HF or satellite. It relays Aircraft Operational Control (AOC), Airline Administrative Control (AAC) and Air Traffic Control (ATC) messages between ground-based organizations and the cockpit. Source: FAA Advisory Circular (AC) 90-117 Data Link Communications. For specific ACARS communications relative to the accident flight, see Attachment 8 - Atlas Air Flight 3591 ACARS Messages.

¹¹ Flight Level (FL) 400 (40,000) is the altitude above mean sea level at a standard barometric pressure of 29.92 inches of mercury.

¹² Automatic Terminal Information Service (ATIS) is the continuous broadcast of recorded non-control information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. The information is continuously broadcast over a discrete VHF radio frequency or the voice portion of a local NAVAID. Arrival ATIS transmissions on a discrete VHF radio frequency are engineered according to the individual facility requirements, which would normally be a protected service volume of 20 NM to 60 NM from the ATIS site and a maximum altitude of 25,000 feet AGL. Source: Aeronautical Information Manual, Section 4-1-13.

Papa.¹³ About 1621Z, GTI3591 contacted ground control for taxi, and was instructed to taxi to runway 09 via taxiways R, Y, T. Seven minutes later GTI3591 contacted the Tower ready for departure at runway 09. About 1632Z, GTI3591 was instructed to fly heading 090 off runway 09, and was cleared for takeoff. According to ACARS information from the airplane, the airplane was airborne at 1633Z. The FO was the pilot flying (PF)¹⁴ and the Captain was the pilot monitoring (PM).¹⁵

The subsequent departure and climb from MIA were normal. About 1650Z, GTI3591 checked on with MIA center (Ft. Meyers high sector - R25) leaving 34,600 feet climbing to FL400. At 1710Z, the airplane's ACARS system sent Atlas Air an automated "stable cruise" report when level at FL400. About 1715Z, GTI3591 requested and received digital ATIS weather information Papa for IAH.¹⁶

About 1717Z, the flight checked on with Jacksonville ARTC Center (ZJX) level at FL400 feet. About 1730Z, GTI3591 made and received another request for IAH digital ATIS weather information, and information Papa was still current. About 1758Z, the Leeville High (LEV-H) controller read Houston Center Advisory 205 on the frequency GTI3591 was in communications with ATC.¹⁷ About 1759Z, GTI3591 checked on with White Lake Ultra High (LLA-UH), and was advised to expect light chop. The controller then provided revised routing to IAH after the GIRLY intersection, and cleared the flight to IAH via the LINKK1 arrival.

¹³ Information Papa at MIA was recorded at 1553Z and showed winds 130 at 16 knots, gusting 21 knots, 10 statute miles visibility, scattered clouds at 2,100 feet, broken clouds at 3,900 and 7,500 feet, temperature/dewpoint 28/23 degrees Celsius, altimeter 30.18 inches mercury.

¹⁴ The Atlas-Southern Flight Operations Manual (FOM), page 11.1.6, stated the following: *The Pilot Flying (PF) is the pilot tasked with manipulating the flight controls, either directly or through the aircraft's autoflight systems. The PF's primary task is to fly and navigate the aircraft in a manner consistent with safe operations and in accordance with the standards and instructions. The PF plans flight operations, ensures a shared mental model exists with all crewmembers, and then executes the plan.*

¹⁵ The Atlas-Southern FOM, page 11.1.6, stated the following: *The PM is the pilot who is tasked with observing and commenting on the flight's progress. The PM's primary task is to "quality check" the flight's operation by ensuring the plan the PF shared is in accordance with the standards and briefing. Recognizing the inevitability of human error on the flight deck, the PM is expected to actively verify that the flight is proceeding according to the plan and alert the PF if the flight deviates from the assumptions of that plan. In addition to the primary duty of flight path monitoring, the PM conducts a series of support roles (i.e. running checklists, communicating over the radios, etc.). Because of the broad nature of the role, arguably, PM duties can be more difficult than PF duties.*

¹⁶ Information Papa at IAH was recorded at 1713Z and showed winds 320 at 18 knots, gusting 42 knots, 8 statute miles visibility with mist, scattered clouds at 1,600 feet, broken clouds at 2,000 and 2,900 feet, temperature/dewpoint 19/12 degrees Celsius, altimeter 29.91 inches mercury. The remarks section included comments about a wind shift and rain ending at the airport and windshear advisories in effect at the airport. See Attachment 8 - Atlas Air Flight 3591 ACARS Messages. At 1720Z, the pilot of a B-737 provided a Pilot Weather Report (PIREP) to ATC. According to the FAA Aeronautical Information Manual (AIM), PIREPS are reports of weather observations made by pilots to assist other pilots with flight planning and preparation, and help National Weather Service (NWS) to verify forecast products, and create more accurate products for the aviation community. The 1720Z PIREP (issued at 1723Z) was made when the B-737 was on descent 10 mile east of IAH, and the pilot reported moderate turbulence at 2,000 feet on final approach. For more detailed weather information, see Meteorology Group Chairman's Factual Report in the docket for this accident.

¹⁷ For more detailed weather information, see Meteorology Group Chairman's Factual Report in the docket for this accident.

About 1801Z, GTI3591 requested and received digital ATIS weather information Sierra for IAH.¹⁸ Five minutes later, ATC issued GTI3591 a descent clearance to FL350 for traffic.

About 1809Z, the Tibby High Radar (TBD-H) controller issued the flight a descent to FL340, and about 1818Z, the flight was cleared to descend via the LINNK1 arrival. Seven minutes later GTI3591 advised the controller they were beginning their descent.

About 1830:37Z,¹⁹ GTI3591 checked in with Houston Approach with ATIS information Sierra and reported descending via the LINNK ONE RNAV arrival. ATC instructed GTI3591 to fly the runway 26L transition when the airplane was descending through 17,800 feet about 73 miles southeast of IAH.

At 1834:08Z, the controller advised GTI3591 there was light to heavy precipitation west of the VANNN intersection, which was about 35 miles ahead of GTI3591 moving eastbound.²⁰ The controller informed the crew that when they got in closer [to the airport] they could expect vectors around the weather.

At 1835:41Z GTI3591 checked in with the final controller as the airplane was at 11,400 feet and descending via the LINNK arrival, and advised ATC they had ATIS information Tango.²¹ The controller then told the crew to expect vectors to runway 26L, and asked how GTI3591 how they wanted to get around the weather, either fly east and join from the northside or “what do you want to do.” About 1836Z, GTI3591 requested and received digital ATIS weather information Tango for IAH.

According to recorded data, about 1836Z the FO made a comment in the cockpit related to a possible primary display failure, and transferred control of the airplane to the Captain.²² The Captain became the PF, and the FO became the PM and would then assume responsibility for radio communications.

At 1836:24, GTI3591 advised ATC they would fly to the west side of the weather. The controller informed the pilot that the only problem he had was that there were a “bunch of departures,” so he needed him descend and maintain 3,000 and to “expedite” his descent.²³ At that point the aircraft

¹⁸ Information Sierra at IAH was recorded at 1752Z and showed winds 320 at 14 knots, 9 statute miles visibility, few clouds at 2,000 feet, scattered clouds at 3,300 feet, broken clouds at 6,000 feet, temperature/dewpoint 21/12 degrees Celsius, altimeter 29.92 inches mercury. The remarks section did not include windshear advisories at the airport. See Attachment 8 - Atlas Air Flight 3591 ACARS Messages.

¹⁹ ATC communications times beginning at 1830Z were derived from the Houston Intercontinental TRACON full transcript received from the FAA (dated February 27, 2019). For additional information, see the Air Traffic Control Group Chairman’s Factual Report in the docket for this accident.

²⁰ The VANNN intersection was 28.1 miles east of IAH on the localizer for runway 26L.

²¹ Information Tango at IAH was recorded at 1802Z as a special observation, and showed winds 320 at 17 knots gusting to 21 knots, 10 statute miles visibility, few clouds at 3,500 feet, scattered clouds at 6,000 feet, broken clouds at 8,000 feet, temperature/dewpoint 22/12 degrees Celsius, altimeter 29.91 inches mercury. The remarks section again did not include windshear advisories at the airport. See Attachment 8 - Atlas Air Flight 3591 ACARS Messages.

²² Up to this point in the flight, according to recorded data, the captain was making the ATC radio calls from GTI3591.

²³ For additional statements from pilots in the vicinity of the Atlas Air flight, see Attachment 25 - Other Pilot

was about 48 south east of IAH at 10,000 feet. GTI3591 did not initially respond, so the controller repeated the descent clearance and told GTI3591 to “hustle” down to 3,000 feet, and informed them that they could expect vectors northbound for a base leg to runway 26L at IAH. GTI3591 again responded to ATC and confirmed the descent down to 3,000 feet, and about 10 seconds later the FDR recorded the speedbrake being extended.

According to recorded data, the FO then commented in the cockpit that he experienced a potential failure of his attitude director indicator/horizontal situation indicator (ADI/HSI) display information, and then made a comment about using the Electronic Flight Information (EFI) switch. This was followed by the Captain commenting on potentially getting the displays back.

At 1837:18Z, the controller instructed the GTI3591 to turn to a 270 heading, and the response to ATC was made by the Captain confirming the turn to heading 270 when the airplane was about 40 miles from IAH and descending through 8,500 feet. Shortly afterwards, according to recorded data, the Captain transferred controls of the airplane back to the FO, who became the PF and the Captain became the PM again. The crew then began setting up the approach into the airplane’s Flight Management Computer (FMC).

The crew then began configuring the airplane for the approach and landing, and extended the flaps to 1. About 25 seconds later, the airplane’s FDR recorded fluctuations in the lateral acceleration of the airplane, and about 5 seconds after these fluctuations were recorded on the FDR, the go-around mode was also recorded as being engaged, followed immediately by an increase in the thrust of the engines.²⁴

At 1838:37Z and while the thrust of the engines was increasing, the controller informed GTI3591 that he would turn the flight northbound for a base leg in about 18 miles, FDR recorded the speedbrakes retracted to the near zero position, and the Captain then responded to ATC “sounds good.” ATC then advised GTI3591 that it was clear on the other side of the weather and they should have no problem getting to the airport.

About a second after this ATC transmission, the FO made an expression of surprise in the cockpit, followed by a comment related to airspeed. The Captain then responded to ATC’s previous transmission with “OK,” which was the last recorded communication between ATC and GTI3591, and occurred as the airplane was about 35 miles from IAH and descending through about 6,000 feet. About 3 seconds later, the FO made a comment regarding the airplane stalling. At 1839:39Z, ATC lost radar contact with GTI3591 about 34 miles from IAH at an altitude of about 5,800 feet. About 16 seconds after the Captain told ATC “OK,” the FDR stopped recording data with the airplane descending at an airspeed of about 433.5 knots and the autopilot engaged.

Statements.

²⁴ At 1838Z, the pilot of a BE36 provided a PIREP to ATC (issued at 1842Z) when the airplane was at 8,000 and 25 mile north of BPT (Jack Brooks Regional Airport in Beaumont/Port Arthur, Texas), reporting moderate turbulence. For more detailed weather information, see Meteorology Group Chairman’s Factual Report in the docket for this accident.

Security camera footage captured the final stages of the flight, and showed the airplane in a steep descent.²⁵ It impacted the ground in a shallow muddy swamp area of Trinity Bay about 2 miles west- southwest of Anahuac, Texas near where the Trinity River enters Trinity Bay. Both flight crewmembers and the jumpseater were fatally injured and the airplane was destroyed on impact.

2.0 Flight Crew Information

The accident flight crew consisted of the Captain and FO. There was one Mesa Airlines pilot occupying one of the flight deck jumpseats.²⁶

2.1 The Captain²⁷

The Captain was 60 years old and resided in Madison, Wisconsin. His date of hire with Atlas Air was September 7, 2015. According to his resume on file at Atlas Air, the Captain was employed by ExpressJet (United Express) in Atlanta, Georgia from July 2005 until he was hired by Atlas Air, and flew as an EMB-145 Captain.²⁸ Prior to ExpressJet, the Captain flew for CommutAir (Continental Connection) based in Plattsburgh, New York from September 2003 to July 2005 as an FO on the Beechcraft B-1900D Airliner, and was a flight instructor for FlightSafety International in Vero Beach, Florida from March 2002 to September 2003.

He attended Embry-Riddle University in Daytona, Beach, Florida and graduated in July 2006 with a Bachelor of Science-Professional Aeronautics degree. He previously was a student at Hardin-Simmons University in Abilene, Texas from 1976 to 1978, and a student at Texas A&M University in College Station, Texas from 1978 to 1982.

A review of the FAA Program Tracking and Reporting Subsystem (PTRS),²⁹ Accident/Incident Data System (AIDS) and Enforcement Information System (EIS) showed no records or reports of any previous aviation accidents or incidents involving the Captain.³⁰

2.1.1 The Captain's Pilot Certification Record³¹

Private Pilot – Airplane Single Engine Land certificate issued September 22, 2000.

²⁵ See also Attachment 26 - Witness Statements.

²⁶ The accident airplane (B-767-375) had one jumpseat located just aft of the pilot seats, and three jumpseats in the rear cockpit along the aft cockpit wall. See section 8.2 Cockpit Configuration of this report. It is unknown which seat the Mesa Airlines pilot occupied on the accident flight.

²⁷ See Attachment 9 - Captain Information.

²⁸ See Attachment 16 - Flight Crew's Resumes and Atlas Applications.

²⁹ The Program Tracking and Reporting Subsystem (PTRS) is a comprehensive information management and analysis system used in many Flight Standards Service (AFS) job functions. It provides the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety Inspectors (ASIs) in the field, the regions, and headquarters. This system provides FAA managers and inspectors with the current data on airmen, air agencies, air operators, and many other facets of the air transportation system. Source: FAA.

³⁰ Source: FAA Safety Performance Analysis System (SPAS) Investigation Package.

³¹ Source: FAA.

Private Pilot – Airplane Single Engine and Multiengine Land certificate issued December 20, 2000.

Private Pilot – Airplane Single Engine and Multiengine Land, Instrument Airplane certificate issued April 5, 2001.

Commercial Pilot – Airplane Multiengine Land, Instrument Airplane, Private Privileges Airplane Single Engine Land certificate issued April 20, 2001.

Flight Instructor – Airplane Single Engine certificate issued September 2, 2001.

Flight Instructor – Airplane Single Engine, Instrument Airplane certificate issued March 13, 2002.

Flight Instructor – Airplane Single and Multiengine Engine, Instrument Airplane certificate issued August 30, 2002.

Last renewed: August 8, 2018.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane, EMB-145 (EMB-145 SIC Privileges Only, EMB-145 Circ Appc – VMC Only) certificate issued March 23, 2006.

Airline Transport Pilot - Multiengine Land, EMB-145 (EMB-145 Circ Appc – VMC Only), Commercial Privileges Airplane Single Engine Land certificate issued June 19, 2011.³²

Airline Transport Pilot - Multiengine Land, B-757, B-767, EMB-145 (B-757, B-767, EMB-145 Circ Appc – VMC Only), Commercial Privileges Airplane Single Engine Land certificate issued November 4, 2015.

2.1.2 The Captain's Certificates and Ratings Held at Time of the Accident

Airline Transport Pilot (certificate issued November 4, 2015)
Airplane Multiengine Land; B-757, B-767, EMB-145 type ratings.³³

Flight Instructor (certificate issued August 8, 2018)
Airplane Single and Multiengine Engine, Instrument Airplane

Medical Certificate - First Class (issued September 6, 2018)
Limitations: Must wear correction lenses

³² The Captain's ATP certificate included "English Proficient."

³³ According to FAA Order 8900.1, Figure 5-88 "Pilot Certification Aircraft Type Designations – Airplane," the B-757 and B-767 series airplanes are common type ratings. See also FAA AC 61-89E *Pilot Certificates: Aircraft Type Ratings*, dated August 4, 2000.

2.1.3 The Captain's Training and Proficiency Checks Completed³⁴

Atlas Air Date of Hire	September 7, 2015
Date Upgraded to Captain on B-767	August 25, 2018
Date of Most Recent Proficiency Training	August 12, 2018
Date of Most Recent Proficiency Check (B-767)	August 25, 2018
Date of Most Recent PIC Line Check (B-767)	October 11, 2018

2.1.4 The Captain's Flight Times³⁵

The Captain's flight times, according to Atlas Air records:

Total pilot flying time	11,172
Total Pilot-In-Command (PIC) time	4,235
Total B-767 series flying time	1,252
Total B-767 PIC flying time	157
Total flying time last 24 hours	2:25 ³⁶
Total flying time last 30 days	34
Total flying time last 90 days	100
Total flying time last 12 months	365

2.2 The First Officer³⁷

The FO was 44 years old and resided in Miami, Florida. His date of hire with Atlas Air was July 3, 2017. The FO was previously employed by Mesa Airlines in Phoenix, Arizona from February 5, 2015 until he was hired by Atlas Air, and flew as an FO on the EMB-175 at Mesa Airlines. Prior to Mesa Airlines, on January 8, 2015 the FO applied to Piedmont Airlines and was offered employment on January 20, 2015, but declined the employment offer on February 5, 2015 and accepted employment at Mesa Airlines. According to Mesa Airlines records, the FO attempted to upgrade to captain on the EMB-175 in May 2017, and was graded unsatisfactory after two simulator sessions and returned to the line as an EMB-175 FO. According to Mesa Airlines records, the FO left Mesa Airlines for "career growth."

He was employed by Trans State Airlines in Bridgeton, Missouri from March 8, 2014 to September 20, 2014 as an FO on the EMB-145,³⁸ and Charter Air Transport in Orlando, Florida from February 13, 2013 to March 4, 2014 as an FO on the EMB-120.³⁹ He was employed by Air Wisconsin from April 20, 2012 to August 13, 2012 as a CRJ FO, and according to records he did not complete CRJ training and submitted a resignation letter on August 13, 2012 citing personal reasons. He was

³⁴ Source: Atlas Air.

³⁵ Source: Atlas Air

³⁶ The 24-hour flight time consists solely of the accident flight from MIA-IAH.

³⁷ See Attachment 10 - First Officer Information.

³⁸ According to Trans States records, the FO left Trans States for "personal reasons."

³⁹ Atlas Air records indicate the FO was employed as a pilot with Charter Air Transport from May 18, 2013 to March 9, 2014. While at Charter Air Transport, the FO applied to GoJet Airlines on November 14, 2013 but was not offered employment. According to records, he left Charter Air Transport for a "better opportunity."

employed by Commutair from May 9, 2011 to June 27, 2011 as a DHC-8 FO, and according to CommutAir records he did not complete DHC-8 training, submitting a resignation letter on June 27, 2011 for “lack of progress in training.”⁴⁰

He was employed at Air Turks and Caicos (InterCaribbean Airways) in Turks and Caicos Islands, British West Indies, from June 2008 to June 2010 as an FO on the EMB-120, and according to the records was furloughed.⁴¹

According to his resume provided to Atlas Air, he attended Florida Memorial College in Miami Florida and graduated with a Bachelor of Science in Aviation Management and a minor in business. He attended the Florida International University in Miami, Florida and graduated on April 30, 2011 with a Bachelor of Arts in Liberal Studies.⁴²

A review of the FAA PTRS, AIDS and EIS database showed no records or reports of any previous aviation accidents or incidents involving the FO.⁴³

2.2.1 The First Officer’s Certification Record⁴⁴

Private Pilot – Airplane Single Engine Land certificate issued July 31, 1997.⁴⁵

Private Pilot – Airplane Single Engine Land, Instrument Airplane certificate issued March 27, 2003.

Commercial Pilot –Airplane Multiengine Land, Instrument Airplane, Private Privileges Airplane Single Engine Land certificate issued July 22, 2003.

- Reissued November 1, 2006.

Commercial Pilot – Airplane Multiengine Land, Instrument Airplane, E-120 (EMB-120 SIC Privileges Only, EMB-120 Circle Apc VMC Only) Private Privileges Airplane Single Engine Land certificate issued May 3, 2007.

⁴⁰ According to Atlas Air records, the FO stated that during a gap in employment from May 2011 to January 2013 he did real estate freelance work and was not employed.

⁴¹ According to Transportation Security Administration (TSA) records, the FO attempted to jumpseat on a Spirit Airlines flight to Nassau, Bahamas on April 13, 2009 but was denied when his employment at Air Turks and Caicos (and Colgan/Continental Airlines) as a pilot could not be verified by either airline or the Federal Air Marshals (FAMS) through TTAC. Records provided by Atlas Air indicated the FO was employed as a pilot for Air Turks and Caicos from June 15, 2008 to June 15, 2010. The Director of Operations for Air Turks and Caicos also wrote a referral letter for the FO dated December 14, 2009 confirming his employment as a pilot.

⁴² No dates were provided on the FO’s resume for his college education at Florida Memorial College. Records confirmed his April 2011 degree at Florida International University. See Attachment 16 - Flight Crew’s Resumes and Atlas Applications.

⁴³ Source: FAA SPAS Investigation Package.

⁴⁴ Source: FAA.

⁴⁵ The FO listed his nationality as Antigua.

Commercial Pilot – Airplane Multiengine Land, Instrument Airplane, E-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued December 13, 2013.⁴⁶

Notice of Disapproval – Airline Transport Pilot, Multiengine Land (EMB-145) (first failure) issued April 22, 2014. Areas of reexamination: Oral exam.

Notice of Disapproval – Airline Transport Pilot, Multiengine Land (EMB-145) (second failure) issued May 11, 2014. Areas of reexamination: 2- Engine non-precision approaches (LOC) full procedure; navigation procedures (oral exam completed on April 26, 2014)

Airline Transport Pilot – Airplane Multiengine Land, EMB-145⁴⁷ (EMB-145 Circle Approach – VMC Only), EMB-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued May 12, 2014.

Airline Transport Pilot – Airplane Multiengine Land, EMB-145 (EMB-145 Circle Approach – VMC Only), EMB-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued August 25, 2014.⁴⁸

Airline Transport Pilot – Airplane Multiengine Land, EMB-145 (EMB-145 Circle Approach – VMC Only), EMB-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued September 30, 2014.⁴⁹

Airline Transport Pilot – Airplane Multiengine Land, EMB-120, EMB-145, ERJ-170, ERJ-190 (EMB-145, ERJ-170, ERJ-190 Circle Approach – VMC Only), EMB-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued April 25, 2015.

Notice of Disapproval – Airline Transport Pilot, Multiengine Land Airplane (B-767) (first failure) issued September 22, 2017 - Areas of reexamination: Area of Operations: III. Takeoff and Departure Phase; IV. Inflight Maneuvers.

Airline Transport Pilot – Airplane Multiengine Land, B-757, B-767, EMB-120, EMB-145, ERJ-170, ERJ-190 (ATP EMB-145, ERJ-170, ERJ-190 Circle Approach – VMC Only), EMB-120 (EMB-120 SIC Privileges Only) Private Privileges Airplane Single Engine Land certificate issued September 26, 2017.

2.2.2 The First Officer's Certificates and Ratings Held at Time of the Accident

Airline Transport Pilot (certificate issued September 26, 2017)
Airplane Multiengine Land; B-757, B-767, EMB-120, EMB-145, ERJ-170, ERJ-190 type ratings

⁴⁶ The FO's December 13, 2013 Commercial certificate included "English Proficient" and changed his nationality to USA.

⁴⁷ Subject to EMB-145 PIC limitations.

⁴⁸ This was an emergency field issuance of the FO's Airline Transport Pilot (ATP) certificate with an expiration of October 31, 2014.

⁴⁹ The EMB-145 PIC limitation was removed.

Private Privileges Airplane Single Engine Land

Medical Certificate First Class (issued November 29, 2018)

Limitations: Must have available glasses for near vision

2.2.3 The First Officer's Training and Proficiency Checks Completed⁵⁰

Atlas Air Date of Hire	July 3, 2017
Date Transitioned to B-767	September 26, 2017
Date of Initial Type Rating on B-767	September 26, 2017
Date of Most Recent Proficiency Training	July 7, 2018
Date of Most Recent Proficiency Check	July 8, 2018
Date of Most Recent SIC Line Check	November 22, 2017

2.2.4 The First Officer's Flight Times⁵¹

The FO's flight times, according to Atlas Air records:

Total pilot flying time	5,073
Total PIC flying time	1,237
Total SIC flying time	1,757
Total B-767 SIC flying time	520
Total flying time last 24 hours	2:25 ⁵²
Total flying time last 30 days	34
Total flying time last 90 days	106
Total flying time last 12 months	375

2.3 Jumpseat Pilot

The jumpseater was a current EMB-175 Captain for Mesa Airlines with a date of hire of July 11, 2013.⁵³ He was 36 years old, and according to FAA records he resided in Houston, Texas and was commuting to work on the accident flight. According to Mesa Airlines records, on February 22, 2019 (the day before the accident) he sent email resignation letter to Mesa Airlines indicating he had accepted a pilot position with United Airlines.⁵⁴ According to the resignation letter, his last day with Mesa Airlines was scheduled to be March 11, 2019.

⁵⁰ Source: Atlas Air.

⁵¹ Source: Atlas Air.

⁵² The 24-hour flight time consists solely of the accident flight from MIA-IAH.

⁵³ According to Mesa Airlines records, the jumpseater was approved in the CASS system, and held a current United States Passport (expiration January 27, 2021).

⁵⁴ United Airlines confirmed that the Mesa Airlines pilot had been given a "conditional job offer" (CJO) to begin employment in early March 2019. Source: Email from United Airlines Senior Investigator – Flight Safety to the NTSB on Tuesday, April 2, 2019 2:01 PM.

According to the Atlas Air Operations Specifications (OpSpecs) A048, Atlas Air was authorized to allow persons eligible under 14 *CFR* 121.547(a)(3) access to the flightdeck using the Cockpit Access Security System (CASS) program and/or the Flight Standards Flightdeck Access Restriction (FDAR) program in accordance with the limitations and provisions of the OpSpecs. Atlas Air's applicable policies and procedures were located in the Atlas-Southern FOM, version 17 dated January 23, 2019, Chapter 3.1.⁵⁵

2.3.1 The Jumpseater's Certificates and Ratings Held at Time of the Accident

Airline Transport Pilot (certificate issued April 9, 2015)⁵⁶

Airplane Multiengine Land, CL-65, ERJ-170, ERJ-190 (ATP CL-65, ERJ-170, ERJ-190 Circle Approach – VMC Only)

Commercial Pilot Privileges Airplane Single Engine Land, English Proficient.

2.4 Flight Crew Experience into IAH (Atlas Air)

2.4.1 Captain IAH Experience

	ActivityDate	TailNo	FlightNo	DepartureStn	ArrivalStn
	6/3/2016	N650GT	5Y518	CVG	IAH
	11/17/2017	N1181A	5Y3508	BWI	IAH
	11/20/2017	N1181A	5Y3508	BWI	IAH
	12/13/2017	N1181A	5Y3508	BWI	IAH
	12/16/2017	N1181A	5Y3508	BWI	IAH
	5/29/2018	N1399A	5Y1997	MIA	IAH
	9/28/2018	N653GT	5Y520	CVG	IAH
	1/2/2019	N1361A	5Y3602	RIV	IAH
	2/23/2019	N1217A	5Y3591	MIA	IAH

Table 1: Captain's prior experience with Atlas Air flying into IAH.⁵⁷

2.4.2 First Officer IAH Experience

CrewID	ActivityDate	TailNo	FlightNo	DepartureStn	ArrivalStn
	11/18/2017	N1373A	5Y3006	CVG	IAH
	11/21/2017	N1049A	5Y3012	CVG	IAH
	10/10/2018	N1489A	5Y3555	BWI	IAH

⁵⁵ Atlas Air and Southern Air shared the same FAA-approved FOM. For additional information regarding the relationship between Atlas Air, Southern Air and Polar Air, see section 12.0 Atlas Air Company Information in this Factual Report.

⁵⁶ The jumpseater's ATP was reissued May 12, 2017 to reflect an address change.

⁵⁷ Source: Atlas Air Director SMS, Safety and Regulatory Compliance in an email to the NTSB dated March 19, 2019.

10/14/2018	N1499A	5Y3058	CVG	IAH
2/23/2019	N1217A	5Y3591	MIA	IAH

Table 2: FO's prior experience with Atlas Air flying into IAH.⁵⁸

2.5 Atlas Air Pilot Training

Atlas Air B-767 ground school and simulator training was conducted at the Atlas Air Training Center in Miami, Florida. Atlas Air used their own instructors and check airmen to conduct pilot training and evaluations.⁵⁹

The Atlas Air approved training program was described in the Atlas Air Flight Operations Training Manual (FOTM).⁶⁰ The FOTM was an FAA-approved manual and was the authority for all training program requirements, policies and supporting information at Atlas Air.

Per OpSpecs A025, Atlas Air maintained current records showing that each crewmember complied with the proficiency and qualification requirements as stated in Part 121, and the records were maintained through the company's Airline Information Management System (AIMS) computer-based record system.

On December 9, 2015, Atlas Air established a Training Review Board (TRB) to represent the company in making decisions under the pilot's collective bargaining agreement with the IBT on whether or not to remove a crewmember from the training curriculum. The TRB was comprised of the Senior Director Flight Procedures – training and standards, the Fleet Captain, and the Atlas Air system Chief Pilot. TRB guidelines were published as an Atlas Air Training and Standards Policy, and TRB decisions were made following a third unsuccessful training event (in any training program), to include additional training or removal from the training program.

Remedial training was outlined in the Atlas Air Remedial Training Protocol, and detailed the types of remedial training to be conducted in the event of an unsatisfactory or incomplete training event in initial, upgrade, transition, recurrent and line check. Remedial training could include a records review, additional training and/or counseling.

2.5.1 The Captain's Atlas Air Training History⁶¹

The Captain (as a new hire FO) successfully completed Atlas Air basic indoctrination training on September 11, 2015, and B-767 ground school on September 27, 2015. He received initial fixed base simulator (FBS) training on the Atlas Air B-767 from October 7, 2015 through October 13,

⁵⁸ Source: Atlas Air Director SMS, Safety and Regulatory Compliance in an email to the NTSB dated March 19, 2019.

⁵⁹ Atlas Air did not conduct pilot training under Advanced Qualification Program (AQP). According to the FAA, the AQP is a voluntary alternative to the traditional regulatory requirements under *CFR* 14, Parts 121 and 135 for pilot training and checking. Under the AQP the FAA is authorized to approve significant departures from traditional requirements, subject to justification of an equivalent or better level of safety. The program entails a systematic front-end analysis of training requirements from which explicit proficiency objectives for all facets of pilot training are derived. Source: https://www.faa.gov/training_testing/training/aqp/.

⁶⁰ Atlas Air, Polar Air and Southern Air conducted pilot training under a single FAA-approved FOTM.

⁶¹ See Attachment 11 - Atlas Training Records – Captain.

2015, and initial full-flight simulator (FFS) training in the Atlas Air B-767 from October 16, 2015 through October 31, 2015.

The Captain's initial B-767 simulator training included stall training in an FFS on October 16, 2015, October 20, 2015, October 29, 2015 and October 30, 2015. On October 31, 2015, the Captain was not recommended for his B-767 type rating ride. According to Atlas Air instructor comments, he was not recommended due to over-speeding the flaps during stall recovery, consistently failing to set missed approach altitude, and missed approach procedures.

On November 1, 2015, the Captain completed remedial training on the B-767 satisfactorily, which included speed awareness during recovery from approaches to a stall, and was subsequently recommended for his B-767 type rating check ride. He satisfactorily completed his B-767 type rating check ride on November 2, 2015, which included an evaluation of a takeoff stall during a turn.

On February 25, 2016, the Captain successfully completed recurrent B-767 training, which included three (3) stalls (takeoff, landing and clean configurations), and on May 19, 2016 and September 5, 2016 and August 12, 2017 he successfully completed proficiency checks which included one takeoff stall in a turn.

On March 7, 2017 and March 4, 2018, he completed recurrent simulator training that again included three (3) stalls.

The Captain completed B-767 upgrade ground training on August 12, 2018. Included in this ground training was a two (2) hour module on crew resource management (CRM)⁶² as required by 14 *CFR* 121.427, and an eight (8) hour module on captain leadership.⁶³ The Captain completed upgrade systems training for the B-767 on August 15, 2018, and from August 16, 2018 to August 23, 2018, he conducted five (5) upgrade FFS training sessions in the B-767, and was recommended for upgrade on the B-767 on August 23, 2018. He successfully passed a captain proficiency check on the B-767 on August 25, 2018.

From September 18, 2018 through October 16, 2018, he completed initial operating experience (OE) on the B-767 as a captain, having successfully passed a line check on October 11, 2018.

His last recurrent training was a line-oriented flight training (LOFT)⁶⁴ simulator session as captain on the B-767 on February 9, 2019.

2.5.2 The FO's Atlas Air Training History⁶⁵

The FO successfully completed Atlas Air basic indoctrination training on July 7, 2017, and B-767 ground school on July 22, 2017. On July 27, 2017, he was not recommended for his B-767 type

⁶² See Attachment 22 – Atlas CRM Training Presentation.

⁶³ Source: Atlas Air FOTM, Curriculums (Upgrade-B767), page 2.1.35.

⁶⁴ See FAA AC AFS-210 *Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation*, dated September 6, 1990.

⁶⁵ See Attachment 12 - Atlas Training Records - First Officer.

rating oral examination and required remedial training. Following 4.5 hours of remedial training, which included TLR⁶⁶ Performance and Aircraft Systems, he was recommended for the oral examination, which he successfully passed on July 29, 2017 and was recommended to begin FBS training on the B-767 on July 30, 2017.

Following his fifth FBS training session, he was not recommended to proceed to FFS B-767 training due to difficulty completing normal procedures. He received one 4-hour remedial training session in the FBS, and successfully completed FBS training on August 8, 2017.

According to the Atlas Air B-747/767 Fleet Captain, the FO began FFS B-767 training on August 10, 2017 and completed two (2) FFS training sessions before his simulator partner complained that he was being held back by the FO. This occurred during the time of a series of Atlas Air instructor and check airman meetings, and due to the lack of available seat-support to continue the FO's training, Atlas Air decided to restart his FFS training from the beginning starting on August 27, 2017.⁶⁷

The FO completed his sixth FFS training session on September 3, 2017 when Hurricane Irma caused a shutdown in training at Atlas Air in Miami, Florida. The FO resumed his FFS training on September 19, 2017. On September 22, 2017, the FO failed his practical B-767 type rating examination due to unsatisfactory performance in crew resource management (CRM),⁶⁸ threat and error management (TEM),⁶⁹ non-precision approaches, steep turns, and judgment.⁷⁰ He received remedial FFS training on September 25, 2017, and successfully passed his B-767 type rating check ride on September 26, 2017.

According to the Atlas Air Boeing 747/767 Fleet Captain, the FO's training difficulties did not meet the criteria for a TRB review.⁷¹

The FO received 53:07 hours of initial OE on the B-767 between October 26, 2017 and November 22, 2017, and completed 115:55 hours of B-767 flight time on January 24, 2018 per 14 *CFR* 121.438(b) (75-hour crew pairing requirement) and 14 *CFR* 121.434.9(g) (100 hours consolidation of skills) requirements.

He completed recurrent LOFT on February 17, 2018 and January 7, 2019, completed his most recent recurrent ground school training on July 7, 2018, and his most recent recurrent simulator

⁶⁶ Takeoff and Landing Report.

⁶⁷ See Attachment 1 - Atlas Air Interview Transcripts.

⁶⁸ For additional information on CRM, see FAA Advisory AC 120-51E *Crew Resource Management Training* dated January 22, 2004.

⁶⁹ References: Klinect, J., Wilhelm, J., & Helmreich, R. (1999). *Threat and error management — Data from Line Operations Safety Audits*, paper presented at the 10th International Symposium on Aviation Psychology, Columbus, OH; Maurino, D. E. (2005, April). *Threat and Error Management (TEM)*, paper presented at the Canadian Aviation Safety Seminar (CASS), Vancouver, BC, Canada. Helmreich, R. (2006, November) *Beyond the cockpit: The spread of LOSA and Threat and Error Management*, paper presented at the 4th ICAO-IATA LOSA & TEM Conference, Toulouse, France.

⁷⁰ In addition, the Atlas Air check airman included in his notes for "judgement:" "Situational awareness very low. Oversped flaps on departure. Easily out of sequence. Procedurally leading to questionable decisions." See Attachment 12 - Atlas Training Records - First Officer.

⁷¹ See Attachment 1 - Atlas Air Interview Transcripts.

proficiency check (PC) on July 8, 2018 where he was graded satisfactory/complete on unusual attitudes, upset recovery maneuvers, and one takeoff stall recovery.

2.6 Atlas Air Proficiency Watch Program (PWP)⁷²

According to the Atlas-Southern FOM, page 5.1.15, Atlas Air was obligated under the law to ensure that the highest level of safety was maintained in its operations, and addressed any unsatisfactory pilot training or checking event.⁷³ The Atlas Air FOTM had provisions for remediation, and the Atlas Air Fleet Captain had wide discretion to provide specific training tailored to aid a crewmember to return to a satisfactory level of performance. A crewmember was considered unqualified to fly after a failed check until it had been remediated and the check was subsequently passed.

The Atlas Air Proficiency Watch Program (PWP) was a program established by Atlas Air to comply with FAA's 14 *CFR* 121.415 requirements and provided a crewmember remedial training and tracking program. The requirement stipulated that an air carrier's training program must include a process for the regular analysis of the performance history of any crewmember that had demonstrated performance deficiencies during training and checking, or experienced multiple failures during checking, and to provide additional training and oversight to ensure those deficiencies were addressed and corrected. The Atlas Air Fleet Captain managed the PWP for their fleet.

The PWP was to monitor and improve the performance of the following flight crewmembers:

- A flight crewmember who fails to complete a training or qualification event satisfactorily.
- A flight crewmember whose performance has been determined by an Event Review Board (ERB) to not have met Company standards and is re-entered into training or qualification events.
- Flight crewmembers who have demonstrated a repetitive need for additional training.

The PWP duration was 6 (six) months from the date of the re-qualification event. Pilots in the PWP were monitored for 6 months. Three months after the re-qualification, the pilot would return for a recurrent flight training (RFT) session. Six months after the re-qualification event, the pilot returned for a proficiency check. During the PWP, a line check would also be conducted on the pilot. Following successful accomplishment of all events of the PWP, Atlas Air would release the pilot from the PWP.⁷⁴

⁷² For additional information, see Attachment 20 - Atlas Air PWP Program (FOTM Revision).

⁷³ Title 14 *CFR* 121.415 stated in part: (h) *Each training program must include a process to provide for the regular analysis of individual pilot performance to identify pilots with performance deficiencies during training and checking and multiple failures during checking. (i) Each training program must include methods for remedial training and tracking of pilots identified in the analysis performed in accordance with paragraph (h) of this section.*

⁷⁴ Source: Atlas-Polar Flight Operations Training Manual (FOTM), Version 6, page 1.8.2 through 1.8.4.

2.6.1 Captain's PWP

Following the Captain's October 29, 2015 failure to be recommended for his B-767 type rating ride, on November 11, 2015, he was placed in the Atlas Air Proficiency Watch Program (PWP) by the Atlas Air B-747/767 Fleet Captain "as a result of your repetitive need for additional training."⁷⁵

On February 22, 2017, he was removed from the PWP in a letter to the Captain from the Atlas Air B-747/767 Fleet Captain, which said "you have successfully completed the requirements of the Atlas Air Proficiency Watch Program (PWP), as defined in the Flight Operations Training Manual (FOTM)."⁷⁶

2.6.2 FO's PWP

Following the FO's failed B-767 type rating ride on September 22, 2017, Atlas Air did not place the FO into the PWP. According to an interview with the B-747/767 Fleet Captain, the PWP was amended in April 2016 (FOTM Bulletin 43, dated April 18, 2016) to exclude a single-failure triggering event for the PWP and include a more subjective review of the pilot's training.⁷⁷ The B-747/767 Fleet Captain said he felt like the FO may have been nervous on his B-767 type rating ride since an FAA inspector was observing the check ride as part of a required observation of the check airman.

The B-747/767 Fleet Captain also stated that he considered the multiple gaps in the FO's training, along with some family issues the FO was experiencing, and decided to monitor the FO's OE before deciding to place the FO into a PWP. According to the B-747/767 Fleet Captain, the FO had no difficulties with his subsequent recurrent training.⁷⁸

2.7 Pilot Records Improvement Act (PRIA)⁷⁹

The "Pilot Records Improvement Act of 1996" (PRIA), as amended, was enacted to ensure that air carriers and air operators adequately investigate a pilot's background before allowing that pilot to conduct commercial air carrier flights.⁸⁰ Under PRIA, a hiring employer cannot place a pilot into service until the employer obtains and reviews the last 5 years of the pilot's background and other safety-related records, as specified in PRIA. Guidance for compliance with PRIA was found in FAA AC 120-68H *Pilot Records Improvement Act and the Pilot Records Database*, dated April 17, 2017.⁸¹

According to the FAA PRIA Program Manager, PRIA was a three phase background check for pilots. The first phase was for a review of FAA records, the second phase was for a review of

⁷⁵ See Attachment 11 - Atlas Training Records – Captain.

⁷⁶ See Attachment 11 - Atlas Training Records – Captain.

⁷⁷ See Attachment 20 - Atlas Air PWP Program (FOTM Revision).

⁷⁸ See Attachment 1 - Atlas Air Interview Transcripts.

⁷⁹ See Attachment 18 - AC 120-68H PRIA.

⁸⁰ The provisions of the act are found in United States *Code* (49 U.S.C.) §44703(h), (i), and (j).

⁸¹ See Attachment 18 - AC 120-68H PRIA.

records from previous employers, and the third phase was for a review of the National Drivers Register (NDR) driver's license records in the state the applicant was registered.⁸²

For previous employer records, PRIA required that a hiring air carrier under 14 *CFR* Parts 121 and 135, or a hiring air operator under 14 *CFR* Part 125, request, receive, and evaluate certain information concerning a pilot/applicant's training, experience, qualification, and safety background, before allowing that individual to begin service as a pilot with their company.⁸³

According to the FAA, the previous employer was required to provide the following:⁸⁴

1. *Records pertaining to the individual, found in – 49 U.S.C. Section 44703 (h) (1) (B) (i)*
2. *Records pertaining to the individual's performance as a pilot, found in – 49 U.S.C. Section 44703 (h) (1) (B) (ii)*

(This includes disciplinary actions; however, these actions must be related directly to the individual's performance as a pilot, and not other types of employment related actions)

Companies were authorized to use 3rd party "Designated Agents" (DA) to conduct the background checks of pilot applicants. According to records provided by Atlas Air, between January 31, 2014 and January 31, 2016 the DA for Atlas Air was Summit Security Services, Inc. per a signed contract to provide PRIA background screening services. Atlas Air subsequently contracted PRIA background services with TruView BSI, LLC from February 1, 2016 to January 31, 2018, and the contract was renewed effective February 1, 2018.

Title 49 U.S. *Code* §44703 "Airman Certificates" stated that an air carrier shall request and receive the records pertaining to "the training, qualifications, proficiency, or professional competence of the individual, including comments and evaluations made by a check airman designated in accordance with section 121.411, 125.295, or 135.337 of such title".

In a response to an NTSB request for a legal definition of "professional competency" during the NTSB investigation into the November 10, 2015 fatal accident involving a British Aerospace HS 125-700A, on March 29, 2016 the FAA stated the following:

Competence is defined as "the quality of being competent; adequacy; possession of required skill, knowledge, qualification, or capacity." As this term is used in PRIA and as it relates to the federal aviation regulations applicable to the aircraft pilot profession, the

⁸² See Attachment 17 – FAA Interview Summaries.

⁸³ Title 14 *CFR* 121.683(a) Crewmember and dispatcher record, stated the following: (a) Each certificate holder shall: (1) *Maintain current records of each crewmember and each aircraft dispatcher (domestic and flag operations only) that show whether the crewmember or aircraft dispatcher complies with the applicable sections of this chapter, including, but not limited to, proficiency and route checks, airplane and route qualifications, training, any required physical examinations, flight, duty, and rest time records; and* (2) *Record each action taken concerning the release from employment or physical or professional disqualification of any flight crewmember or aircraft dispatcher (domestic and flag operations only) and keep the record for at least six months thereafter.*

⁸⁴ Source: http://www.faa.gov/pilots/lic_cert/pria/guidance/.

*competency of a pilot to serve as a flight crewmember is dependent upon the sufficiency of the individual's knowledge, skills, judgment and flight experience. In addition, the competency of a pilot is dependent upon the individual's demonstration of compliance with the applicable operating standards. The plain meaning of professional competence, as this term is used in PRIA, is thus, an extension of the requirement to furnish records related to pilot training, qualifications and performance on checking and other testing events.*⁸⁵

The FAA further responded that “determining whether a specific scenario would constitute a lack of ‘professional competence’ should be left to the discretion of an air carrier or other operator.”⁸⁶

2.7.1 Pilot Records Database (PRD)

According to the FAA, the Pilot Records Database (PRD) is used to facilitate the sharing of pilot records among air carriers in a clearinghouse managed by the FAA, and was introduced in FAA AC 120-68G. All Part 119 certificate holders and fractional ownerships can register to access the PRD and evaluate the available FAA data for each individual pilot candidate prior to making a hiring decision.⁸⁷ Pilots holding an FAA Commercial or Airline Transport Pilot certificate with a current medical can now register in PRD and see their FAA records.

According to the FAA PRD Program Manager, PRD was mandated by Congress in 2010 after a series of accidents that had to do with the availability of pilot records. The intent of PRD was similar to PRIA, but would provide hiring airlines the FAA, NDR and previous employer records for a 5-year review of a pilot applicant in a single electronic database.⁸⁸ According to AC-120-68H, there were 4 stages of implementation of PRD, and the FAA currently was in stage 3 – voluntary use. FAA records availability of PRD is voluntarily available to air carriers to review a pilot’s certification history. Air carriers that chose to use PRD now as part of the hiring process may require pilots to use PRD to grant consent for them to see the pilot's FAA records as part of the hiring process.

At the time of this writing, the NDR and industry records portion of PRD are not yet active and available to operators, and those two portions of PRD are undergoing the Notice of Proposed Rulemaking (NPRM) process at the FAA. According to the FAA PRD program manager, in 2010 the FAA directed all Part 121 operators to begin retaining airman records with the intention of loading that industry information into PRD. Once fully implemented following the NPRM process, PRD will provide hiring operators FAA records, NDR records and industry records (former employer records) going back to 2010 for evaluation of a pilot applicant.

⁸⁵ See FAA legal interpretation from Mark Bury, Assistant Chief Counsel for Regulations, FAA AGC-200, to Jason Lorenzo on September 12, 2014.

⁸⁶ Reference: NTSB Accident Report AAR1603 “Crash During Non-precision Instrument Approach to Landing Execufight Flight 1526 British Aerospace HS 125-700A, N237WR” dated October 18, 2016.

⁸⁷ Source: https://www.faa.gov/regulations_policies/pilot_records_database/.

⁸⁸ See Attachment 17 – FAA Interview Summaries.

2.7.2 Captain's PRIA

The Captain's PRIA background check for Atlas Air was completed by Summit Security Services, Inc. on September 22, 2015, and included a check of the NDR, FAA records, and past employers disclosed by the Captain. The Captain's resume and application provided to Atlas Air listed his employment with ExpressJet, CommutAir, and FlightSafety International, and the PRIA background check conducted by Atlas Air included all three employers.⁸⁹

2.7.3 FO's PRIA⁹⁰

The FO's PRIA background check for Atlas Air was completed by TruView BSI, Inc. on August 11, 2017, and included a check of the NDR, FAA records, and past employers disclosed by the FO. The FO's resume and application provided to Atlas Air listed his employment with Mesa Airlines, Trans States Airlines, Charter Air Transport, and Air Turks and Caicos. His resume and application did not list employment with Air Wisconsin (April 20, 2012 through August 13, 2012) or CommutAir (May 3, 2011 through June 27, 2011).

When asked to explain any gaps in employment, the FO stated the following on his Atlas Air application: "There were time when I was furloaded [sp] and also went to college to attained [sp] degrees." Air Wisconsin and CommutAir were not part of the PRIA requested information for the background checks conducted for Atlas Air on the FO.⁹¹

According to the Director of Training, Atlas Air was not aware of the FO's employment at either Air Wisconsin or CommutAir, or that he was unsuccessful in both training programs. He further said they would have liked to have had that information for further evaluation of the FO based on a trend in his training, and with that information "we would not have offered him a position" based on the FO's failure to disclose that information on his application.⁹²

On the FO's Atlas Air employment application, when asked "have you ever failed an initial, upgrade, transition, or recurrent proficiency check," the FO answered "yes," and added "when I was doing my ATP check ride, I had to redo one non precision approach I have all documents to support this." According to Mesa Air training records provided to Atlas Air, the FO was unsuccessful on his attempt to upgrade on the EMB-175 in May 2017 after being graded unsatisfactory after two simulator sessions.⁹³

According to the Atlas Air Director of HR, the FO's failure to upgrade to captain at Mesa Air did not "red flag" as a training failure through the PRIA process. When asked how Atlas Air classified an unsuccessful attempt to upgrade to captain, she said "if I had seen that, we probably would've asked him about it and then he would've explained what it was." The Atlas Air Director of Training, who was also part of the interview process, did not recall PRIA showing the failure to

⁸⁹ See Attachment 14 - Captain PRIA Documentation.

⁹⁰ See Attachment 15 - First Officer PRIA Documentation.

⁹¹ For instructor comments on the FO's training at Air Wisconsin, see Attachment 2 - Records of Conversation.

⁹² For additional information, see Attachment 1 - Atlas Air Interview Transcripts.

⁹³ For instructor comments on the FO's training at Mesa Airlines, see Attachment 2 - Records of Conversation.

upgrade as a “red flag,” and thought the information provided by Mesa Air was vague, and should have been identified for additional follow-up.⁹⁴

According to Trans States training records provided to Atlas Air, the FO was graded unsatisfactory on his EMB-145 type rating oral examination on April 22, 2014, was graded unsatisfactory on his EMB-145 ATP check ride on May 11, 2014, and was graded unsatisfactory on his EMB-145 line checks on August 15, 2014 and September 8, 2014.

According to the Atlas Air Director of Training, he did not recall seeing the FO’s Trans States unsatisfactory line checks in the FO’s PRIA documentation during the FO’s interview process at Atlas Air.⁹⁵

3.0 Atlas Air Pilot Hiring

According to Atlas Air, as of August 6, 2019 Atlas Air and Southern Air had hired 324 pilots (203 at Atlas Air and 121 at Southern Air) with average total flight times of 5,738 and 5,391 hours respectively. The combined number was 336 pilots with an average flight time of 6,550 hours in 2018, 316 pilots with an average flight time of 6,643 hours in 2017, 323 pilots with an average flight time of 6,807 hours in 2016, 341 pilots with an average flight time of 6,498 hours in 2015, and 92 pilots with an average flight time of 7,303 hours in 2014. In addition, 64% of the pilots at Atlas Air and Southern Air had been with the companies for 5 years or less.⁹⁶

According to Atlas Air, in 2017 the company hired 36% of their pilots with regional airline backgrounds, 22% with previous widebody (B-747/777/767, A-330) backgrounds, and 15% with military backgrounds.⁹⁷

3.1 Minimum Qualifications

Minimum Atlas Air pilot qualifications for employment were detailed in the Atlas-Southern FOM, page 3.1.3. Those minimums included the following:

Flight Time Requirements

- 1,500 flight hours
- and
- A minimum of 500 hours Turbine time
- A minimum of 1,000 hours fixed wing or 500 hours with a Part 121 carrier

FAA Requirements

- 747/767/777: FAA Multi-engine Airline Transport Pilot with English Proficiency endorsement
- Current FAA Class 1 Medical Certificate

⁹⁴ See Attachment 1- Atlas Air Interview Transcripts.

⁹⁵ See Attachment 1 – Atlas Air Interview Transcripts.

⁹⁶ Source: Captain Leadership – Worldwide Command presentation (slide 51) presented to upgrading Atlas Air captains.

⁹⁷ Source: Leadership for Captains presentation (slide 48) presented to upgrading Atlas Air captains.

- FCC Radio License

3.2 Atlas Air Interview Process

Pilot applicants to Atlas Air could first apply to the airline through the Applicant Tracking System (ATS), or by sending resumes directly to the airline. An initial review was conducted to ensure the applicant met the minimum pilot requirements. Following a resume review, a recruiter would contact the applicant for an initial phone screening to discuss the application before an interview was scheduled.

Atlas Air new pilot interviews were conducted by Atlas Air Flight Ops Management pilots, Human Resource (HR) personnel, Flight Ops team and Technical Panel team pilots. Applicants were scored on a rating sheet by the personnel panel and technical panels separately, and then both panels would meet and discuss each applicant and decide if the candidate would be offered employment. The personnel panel rated candidates on several factors, including overall organizational fit, employment history, CRM/personality/assertiveness, training history and experience level. The technical panel was a 20-30 minute review of the applicant's technical skills, general knowledge level for where they were at in their career, and trainability.⁹⁸

Applicants were rated as Highly Recommended, Recommended or Do Not Recommend for Employment.⁹⁹ According to Atlas Air, generally, those applicants that passed both the personnel and technical panels were offered employment.¹⁰⁰ The process was controlled by the Atlas Air Director of HR and the Senior Director of Flight Procedures and Training. All final decisions were made by HR and flight ops together.

According to the Director of HR, in the last year Atlas Air received 1,200 to 1,400 pilot applications, which had declined in the past years from a previous 3,000 applications per year. Since about 2015, Atlas Air had been hiring about 300 pilots each year, and for 2019 Atlas and Southern Air were scheduled to hire about 700 pilots (split about evenly). She stated that in the last 3 years, they had seen a "tough pilot market" with the current pilot shortage. She stated that the total flight time for applicants to Atlas Air was averaging about 6,500 hours. Atlas Air also had pilot pathway programs through GoJet Airlines and Ameriflight that provide guaranteed pilot interviews with Atlas Air.

Subsequent to the accident, Atlas Air revised their interview process to include a telephone screening where identical interview grading questions used in the regular interview were asked over the telephone to gauge credibility and consistency in the applicant's answers during the formal interview. In addition, a pilot logbook review has also been added to the interview process.¹⁰¹

⁹⁸ See Attachment 19 - Atlas Air Pilot Interview Process.

⁹⁹ The accident FO was rated "highly recommend" by both panels. The rating sheet included a disclosure from the FO regarding a 2014 ATP failure. A hand-written comment on the FO's rating sheet stated, "really nice," and that no Level D simulator evaluation of the FO was required for the interview process. See Attachment 16 - Flight Crew's Resumes and Atlas Applications

¹⁰⁰ Source: Email to the NTSB from the Atlas Air Vice President Safety and Regulatory Compliance, on Monday, June 17, 2019 8:07am.

¹⁰¹ Source: Email to the NTSB from the Atlas Air Vice President Safety and Regulatory Compliance, on Monday,

4.0 Flight Crew Responsibilities

Atlas Air flight crewmember responsibilities were defined in the Atlas-Southern FOM, page 3.1.1 through 3.1.3. According to the Atlas-Southern FOM, each Atlas Air crewmember was responsible for the following:

- After safety and regulatory compliance are assured, completion of schedules and passenger comfort are paramount.
- Know their schedule and flight assignment.
- No flight crewmember has the authority to modify flight equipment in any way.
- Being fit for scheduled duty.
- Being available for duty at report time.
- Being available when transportation departs for the airport unless otherwise coordinated.
- Being at the assigned duty stations on time, as specified in this manual, unless operational situation dictates otherwise.
- If unable to be available and fit for duty due to fatigue, to comply with the *Fatigue Call and Fatigue Reporting Policy* on page 3.1.23.

4.1 Captain Responsibilities

According to the Atlas-Southern FOM, page 3.1.1, the captain was the final decision-making authority on the aircraft, but it was the responsibility of all crewmembers to contribute to the decision making process to ensure that the best decisions were made. All crewmember should balance assertiveness with tact. According to the FOM, safety and compliance with Atlas Air procedures and FAA regulatory standards were the highest priorities for Atlas Air and its personnel.

Specific to the captain's responsibilities, the Atlas-Southern FOM stated that the captain was responsible for the following:

- Final authority as to the safe and efficient operation of the airplane in accordance with the applicable aircraft Flight Crew Operating Manual, Flight Operations Manual, and the regulations.¹⁰²
- Safety of the crew, customers, cargo, equipment, and overall safe conduct of flight.
- Act as Inflight Security Coordinator (ISC) when dealing with security matters.
- The PIC has absolute authority relative to the safe operation of the aircraft and over crewmember actions from arrival at the aircraft until leaving the aircraft.
- The PIC is the final decision making authority on the aircraft, but it is the responsibility of all crewmembers to contribute to the decision making process to ensure that the best decisions are made.

June 17, 2019 8:07am.

¹⁰² Title 14 *CFR* 91.3 states that the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft. Further, in an in-flight emergency requiring immediate action, the pilot in command may deviate from any rule of this part to the extent required to meet that emergency.

- Ensures signed Dispatch/Flight Release and all other required documents are retained as required by Company [Atlas Air] policy and regulations.
- Is jointly responsible with the Dispatcher for the initiation, continuation, diversion and termination of the flight.
- Ensures relief pilot duties are clearly defined and assigned for irregular and emergency situations on augmented flights.
- Refer to *Flight Crew Responsibilities – Winter Operations* on page 10.1.22 for further responsibilities specific to Winter Operations.
- If applicable, ensures the aircraft is ETOPS compliant and properly briefs the flight crew on ETOPS procedures prior to departure.

The captain is directly responsible to their Chief Pilot for the following duties:

- Ensures sound judgement and the safe and efficient operation of flights.
- Constant awareness of all flight parameters, including on-time performance and the effect on customer flight schedules, customer service and image of the airline.
- Ensuring proper performance of duties by other crewmembers.
- Report repeated failure of other members of his crew to properly perform their duties.
- The PIC should be familiar with the professional background and experience level of his assigned crewmembers including experience in type and recency of experience.
- Be current and have operational knowledge of the Flight Operations Manual, Flight Crew Operating Manual, Jeppesen Airway Manual, and pertinent regulations.
- Mentorship of new First Officers in the practical and technical details of being a well-rounded professional airline Captain.
- Active preparation of senior First Officers for the requirements of airline command.
- Monitor and counsel other flight crewmembers with respect to the standards of uniform wear and appearance.
- Ensure that the flight deck is free from sexual or racial harassment and the display of offensive material on all flights.

4.2 First Officer Responsibilities

According to the Atlas-Southern FOM, page 3.1.2, the FO must bring any information that had an impact on operational safety to the attention of the captain. FO's will ask questions, state recommendations, and constantly evaluate the planned course of action. If any crewmember had any doubts about the safety of flight, they must speak up with appropriate persistence until there was a resolution. Generally, FO's are directly responsible to the Chief Pilot. During flight, the FO is responsible to the captain.

Specific to the FO's responsibilities, the Atlas-Southern FOM stated that the FO was responsible for the following:

- Assist the Captain in the safe and efficient conduct of the flight.
- Constant awareness of all flight parameters, including on-time performance and the effect on customer flight schedules, customer service and image of the airline.

- Proficiency in the duties and responsibilities required of a SIC [second in command].
- Advise the Captain of any abnormality during ground and flight operations.
- Refer to Flight Crew Responsibilities – Winter Operations on page 10.1.22 for further responsibilities specific to Winter Operations.
- Be current and have operational knowledge of the Flight Operations Manual, Flight Crew Operating Manual, Jeppesen Airway Manual, and pertinent regulations.
- Assist in emergency and abnormal/non-normal procedures.

In addition, the Atlas-Southern FOM, page 3.1.3, stated that all pilots were PIC rated, and Atlas Air expected FOs to upgrade. All FOs were expected to actively prepare themselves for the requirements of captain. FOs, to the extent possible, must actively participate in the monitoring and decision-making process of each flight to ensure that they cultivate the required experience, perspective, and judgement for the eventual transition to captain.

5.0 Command Authority and Expectations

According to the Atlas-Southern FOM, page 10.1.1, the captain has full responsibility and is the final authority for the safe operation of the aircraft. The captain ensured the actions of all crewmembers were performed in a manner which promotes maximum safety, regulatory compliance, passenger comfort, efficiency, and on-time performance.¹⁰³

The Atlas-Southern FOM, page 19.1.2, regarding emergency situations, stated the following in part:

The crewmember that first recognized the emergency should announce it in a firm, clear voice. If the fire bell is ringing, it should be silenced promptly without command. When the pilot flying is informed of, or detects, and impending emergency or abnormal condition, he will:

- *Fly the aircraft*
- *Evaluate the situation*
- *Call for the appropriate checklist*
- *Complete the prescribed procedure*

One pilot must fly the airplane. The Captain may elect to fly the airplane himself or to have the other pilot fly it. Assuming control of the airplane does not relieve the Captain of the responsibility for directing crew action. Ensure positive transfer of airplane control from one pilot to the other. During the execution of abnormal/non-normal and emergency procedures a crosscheck and verbal confirmation by two flight crew members (dual response) occurs before the actuation of any critical aircraft system controls. These control address as a minimum engine thrust levers, fuel master or control switches, engine fire switches, and IDG disconnect switches.

¹⁰³ For additional information, see Attachment 23 - Atlas Air Operational Safety and Crew Concepts.

5.1 Transfer of Control

According to the Atlas-Southern FOM, page 10.1.3, crewmembers must continuously monitor the flight path and energy of the aircraft to ensure the projected path was correct and safe. The FOM further stated that the safe transfer of control should be made with no assumptions. Prior to transferring control, the PF should advise the PM of all pertinent information concerning automation, navigation, and configuration. The pilot receiving control should acknowledge the information and transfer.

The FOM further stated that ensuring a shared mental model on how the aircraft was to be flown while the PF was heads down ensured one pilot was always flying the aircraft.¹⁰⁴

5.2 Safe Aircraft Operation

According to the Atlas-Southern FOM, page 10.1.2, crewmembers were prohibited from operating aircraft in a careless or reckless manner so as to endanger life or property. Maneuvers not necessary for the safe and orderly progress of flight were prohibited. Pitch and bank angles should remain within the safe operational limits while operating in manual or auto flight.

5.3 Two-Alert Policy – Flight Crew Incapacitation

The Atlas-Southern FOM, page 10.1.4, stated the following in part:

Consistent use of Standard Operating Procedures (SOPs) is the key to early detection of incapacitation of a fellow crewmember. If it is necessary to deviate from SOP, the PF should brief other crewmembers. A pilot's unstated deviation from SOP and failure to respond to queries, alerts or warnings from other crewmembers may be the first indication of incapacitation.

If a deviation occurs, the PM should query, alert, or warn the PF. After two communications with no response from the PF, the other crewmember(s) should suspect incapacitation and consider taking action. In critical situations, action may be taken prior to a second communication.

The Atlas-Southern FOM, page 19.1.9, further stated a pilot's unstated deviation from SOP and failure to respond to queries, alerts, or warnings from other crewmembers may be the first or only indication of incapacitation. Incapacitation should also be suspected if a pilot did not respond to any verbal communication associated with a significant deviation from the intended flight path. Actions taken when incapacitation was suspected should be tempered with judgement and be appropriate to the particular situation.

¹⁰⁴ For additional FAA guidance on PF/PM roles and responsibilities, see FAA Safety Alert for Operators (SAFO) 15011, dated November 17, 2015. For additional FAA guidance on standard operating procedures and pilot monitoring duties for flight deck crewmembers, see FAA AC 120-71B, dated January 10, 2017.

6.0 Flight Crew 72-hour History¹⁰⁵

6.1 Captain's Recent Activities

The Captain was married and lived with his wife in Madison, Wisconsin. Investigators contacted the Captain's wife and attempted to contact his daughter, who resided in North Carolina, to obtain information about his recent activities, but were unsuccessful at obtaining any information.

On Wednesday, February 20, 2019 the Captain was in hotel reserve status (staying in a hotel at company expense) near Ontario International Airport (ONT).

On Thursday, February 21, 2019 the Captain was in hotel reserve status (staying in a hotel at company expense) near Ontario International Airport (ONT).

On Friday, February 22, 2019 the Captain went on duty at 0257 Eastern Standard Time (EST), operated a flight from ONT to MIA with the first officer for a block flight time of 4 hours 29 minutes, and went off duty at 0921 EST. Hotel records indicate that he checked into the Crowne Plaza Miami Airport at 0931 EST. Hotel key card records indicate that he entered his room at 0932 EST and 1055 EST, paid for two beers at 1838 EST, and entered his room for the last time at 1902 EST.

On Saturday, February 23, 2019 shuttle service records indicate that the Captain departed the hotel for the airport at 0909 EST. Atlas Air crew scheduling records indicate that he went on duty at 0938 EST and operated the accident flight from MIA to IAH.

6.2 First Officer's Recent Activities

The FO was single and resided in Miami, Florida. Investigators attempted to contact his daughter, who resided in Florida, and contacted his girlfriend, who resided in New Jersey, to obtain information about his recent activities, but were unsuccessful at obtaining any information.

On Wednesday, February 20, 2019 the FO was off duty. His activities are unknown. On Thursday, February 21, the FO was off duty. His activities are unknown.

On Friday, February 22, 2019 the FO went on duty at 0257 EST, operated a flight from ONT to MIA with the Captain for a block flight time of 4 hours 29 minutes, and went off duty at 0921 EST. Hotel records indicate that he checked into the Crowne Plaza Miami Airport at 0924. Hotel key card records indicate that he entered his room at 0921 EST and 2057 EST.

On Saturday, February 23, 2019 hotel key card records indicated that the FO entered his room for the last time at 0649 EST. Shuttle service records indicated that he departed the hotel for the airport at 0909 EST. Atlas Air crew scheduling records indicate that he went on duty at 0938 EST and operated the accident flight from MIA to IAH.

¹⁰⁵ See Attachment 21 - Flight Crew 72-hour History Documents.

7.0 Medical and Pathological Information

7.1. Captain's Medical Information

The Captain's most recent FAA first class medical certificate, dated September 6, 2018, bore the limitation "must wear corrective lenses." Records indicated that his distant visual acuity was 20/30 correctable to 20/20, and his intermediate and near vision acuity were 20/40 correctable to 20/20. The results of the exam were otherwise unremarkable. On the application form for this certificate, the Captain checked "no" for item 17a "do you currently use any medication (prescription or nonprescription)" and "no" to question 19 "visits to health professional within last 3 years."

Specimens from the Captain were unsuitable for toxicological testing.

7.2 First Officer's Medical Information

The FO's most recent FAA first class medical certificate, dated November 29, 2018, bore the limitation "must have available glasses for near vision." Records indicated that his near vision acuity was 20/30 with both eyes, correctable to 20/20. The results of the exam were otherwise unremarkable. On the application form for this certificate, the FO checked "no" for item 17a "do you currently use any medication (prescription or nonprescription)" and "no" to question 19 "visits to health professional within last 3 years."

A muscle tissue specimen from the FO that was sent by the local medical examiner to the FAA's Forensic Toxicology Lab in Oklahoma City, Oklahoma, tested negative for ethanol and a variety of legal and illegal drugs.

8.0 Airplane Information



Photo 1: Accident airplane N1217A.¹⁰⁶

¹⁰⁶ Source: [Airliners.net](https://www.airliners.net).

The accident airplane was a Boeing 767-375BCF (Boeing Converted Freighter), registration number N1217A, serial number 25865, and was manufactured in 1992. It had an airworthiness certificate dated June 6, 2017. It was a fixed wing multiengine transport category aircraft with 2 turbine air generator engines (CF6-80C2B6F) with winglets installed on each wing, and configured for cargo operations. It was registered to Andromeda Leasing I, LLC in Purchase, New York. According to maintenance records, the airplane had 91,063.02 total flight hours with 23,316 total flight cycles at the time of departure from MIA on February 23, 2019.

8.1 Airplane Dimensions

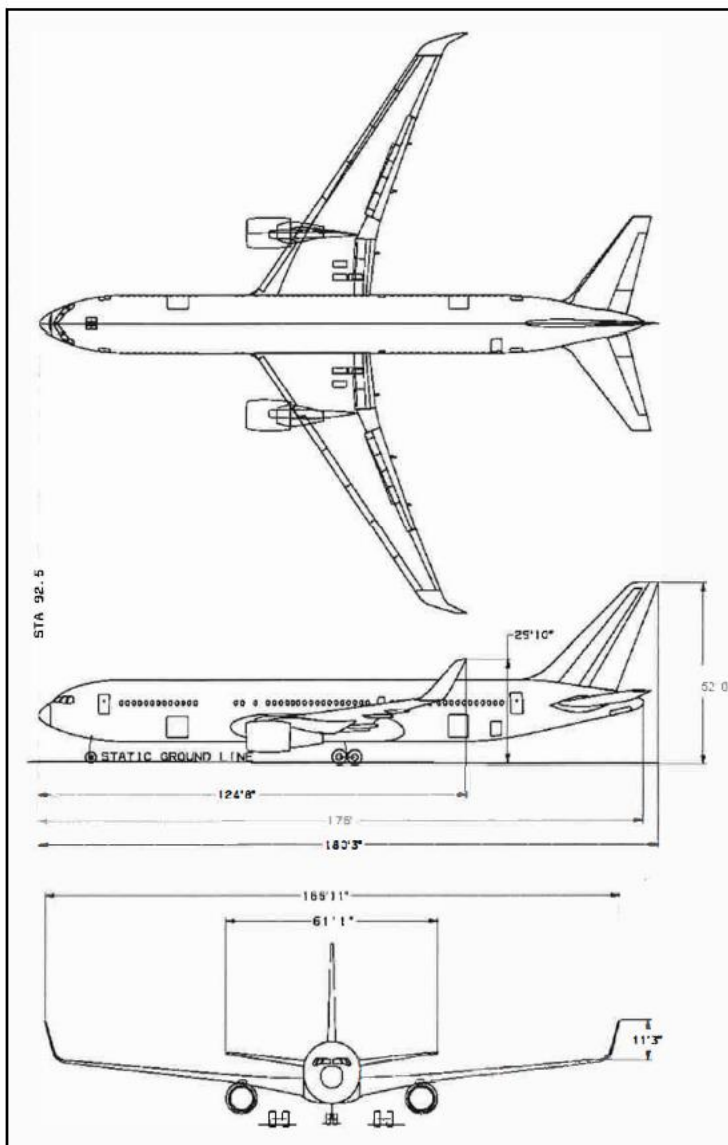


Figure 1: B-767-300BCF Winglet-installed airplane dimensions.¹⁰⁷

¹⁰⁷ Source: Atlas Air Weight and Balance Manual, page 5.2.3.

8.2 Cockpit Configuration

The B-767-300BCF flight deck occupant seating arrangement is shown below (see Figure 2). The locations represent the operating crew and authorized flight deck personnel seated at takeoff positions. The total occupancy, including flight deck and supernumeraries, was not to exceed six (6). The supernumerary area was part of the flight deck, and furnishing items in the supernumerary area included the galley, lavatory, and cargo area access door.

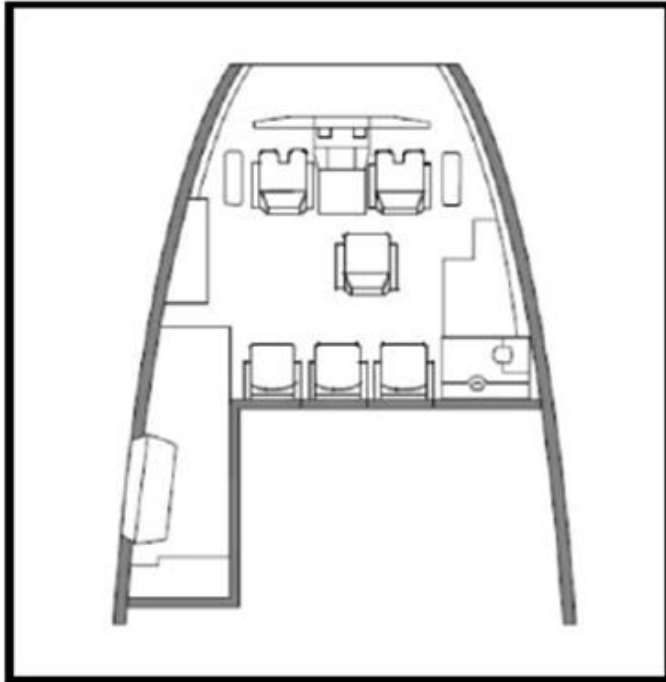


Figure 2: Boeing 767-300BCF cockpit configuration.¹⁰⁸

¹⁰⁸ Source: Atlas Weight and Balance Manual, page 5.2.4.

Figure 5.2.4. B767-300BCF Supernumerary Area

Photo 2: B-767-300BCF Supernumerary Area.¹⁰⁹

The Atlas Air weight and balance program was defined in OpSpecs A099, and the loading schedule instructions and weight and balance control procedures were outlined in the Atlas Air Weight and Balance Manual (version 2, dated April 7, 2017).¹¹⁰

The following table was derived from the information contained in the load sheet printout provided to the captain of the accident flight.¹¹¹

WEIGHT & BALANCE (pounds) (maximum certificated weights in bold)¹¹²	
Basic Operating Weight ¹¹³	185,646
Passenger weight (Jumpseat)	240
Baggage/Cargo Weight (Max allowed: 123,072)	25,933
Zero Fuel Weight	211,819

¹⁰⁹ Photo excerpted from the Atlas Air Weight and Balance Manual, page 5.2.5.

¹¹⁰ Reference: Atlas Air Weight and Balance Manual, Volume I – 767 (Version 2 dated April 7, 2017).

¹¹¹ For detailed weight and balance information, see Attachment 4 - Weight and Balance Information.

¹¹² Maximum structural weights were located in the Atlas-Polar FCOM 767, Volume 1 (Revision 14 dated May 22, 2018), page L.10.4.

¹¹³ The Basics Operating Weight included the weight of the two pilots. According to the Atlas Weight and Balance Manual, page 5.1.4, in accordance with the guidance contained in the FAA's AC 120-27E, Atlas used a standard average weight of 243 pounds for flight crewmembers, ACMs, authorized jumpseat personnel, which included their appropriate carry-on baggage (assumes that each occupant has a total of two (2) carry-on items; one (1) flight bag and one (1) roller bag).

Maximum Zero Fuel Weight	309,000
Takeoff Fuel Weight	37,700
Taxi Fuel Weight	1,400
Ramp Weight	250,919
Maximum Taxi/Takeoff Weight (N1217A)	408,483
Actual Takeoff Weight (-1,400 taxi burn)	249,519
Maximum MIA Takeoff Weight (Landing limited)	346,658
Minimum Flight Weight	189,850
Estimated Fuel Burn (IAH)	20,658
Estimated Weight on Landing (IAH)	228,861
Maximum Landing Weight	326,000
Takeoff CG (% of MAC)	20.7% (TOW MAC)
CG Limits (FWD/AFT)	7%/35.0%
Takeoff Stab Trim	2.3
Takeoff Flaps	5
V1/VR/V2	124/129/136
Landing VREF (25 degrees flaps)	126

There was no hazardous material (HAZMAT) or dangerous goods (DG) loaded on the accident flight, and there was no requirement for completion of the Notification to Captain (NOTOC) Form per 14 *CFR* 175.33.¹¹⁴

8.3 Cargo Loading

8.3.1 General¹¹⁵

The accident flight was parked in Miami at the MIA Cargo City location (building 716) parallel to runway 12/30 and near the ATC control tower on the west side of the airport. The hanger Atlas Air used for its Amazon Air flights had an A side and a B side. The hanger A side was used for off-loading of inbound aircraft, and hanger B side was used for cargo build-up and loading.

¹¹⁴ Source: Atlas-Southern FOM, page 14.1.5. Title 14 *CFR* 175.3 stated that the operator of the aircraft must provide the pilot-in-command and the flight dispatcher or other ground support personnel with responsibilities for operational control of the aircraft with accurate and legible written information (e.g., handwritten, printed, or electronic form) as early as practicable before departure of the aircraft, but in no case later than when the aircraft moves under its own power.

¹¹⁵ For documentation specific to the cargo loading of the accident flight, see Attachment 4 - Weight and Balance Information.



Photo 3: Atlas Air MIA cargo build-up hanger.¹¹⁶

StratAir personnel performed the build-up of the pallets in the warehouse and transport to airplane parking spot. StratAir used two scales on the hanger B side for measuring the weight of the cargo. Calibration certification for each scale was every 30 days, and StratAir used a 1,000 pound concrete weight for daily scale checks. Each scale had a wall-mounted display with a digital readout of the weight in pounds, shown in increments of 10 pounds.

¹¹⁶ Photo taken by NTSB investigators on February 27, 2019.

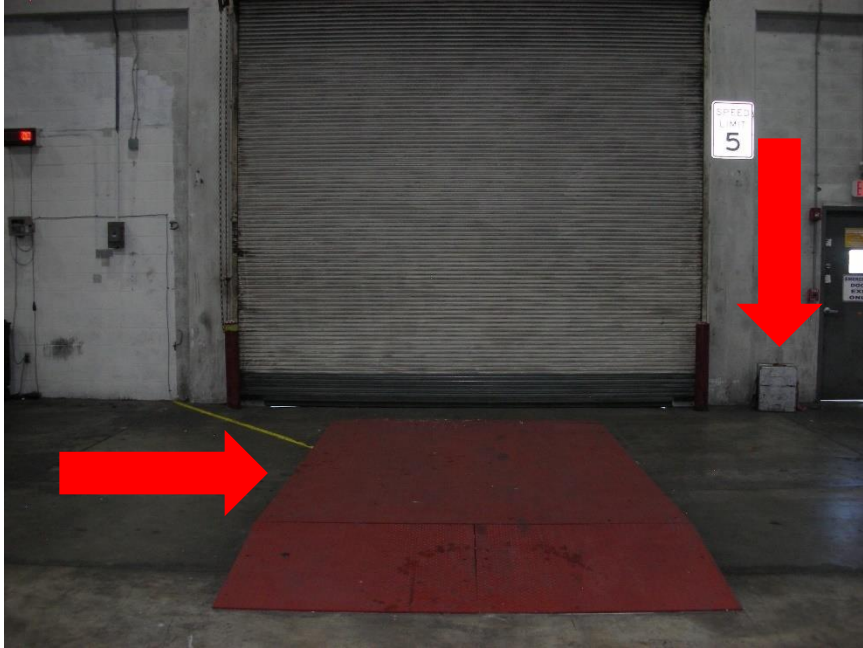


Photo 4: Cargo weighing area (the red arrow to the left indicates one to the hanger B scales, and the red arrow to the right indicates a 1,000 pound concrete weight).¹¹⁷

The Atlas Air Amazon Air flights were normally parked in front of the cargo loading hanger. The accident airplane was about 150 yards down at that end of the hanger at spot 15B because Dade County was painting the ramp spots in front of the warehouse normally used for the Amazon Air flights.



Figure 3: Google Earth image of MIA Cargo City parking.¹¹⁸

National Airport Services (NAS) personnel marshalled, wing walked and operated the ground equipment for Atlas Air Amazon Air flights at MIA. NAS personnel physically loaded and unloaded the aircraft under the supervision of a StratAir Loadmaster (who also acted as the flight's Ground Security Coordinator – GSC), a StratAir load verifier, and an Atlas Air representative. The airplane was loaded first in the front lower cargo compartment, then the main deck, and then the aft lower compartment. The unloading occurred in reverse order. Total ground crew involved in

¹¹⁷ Photo taken by NTSB investigators on February 27, 2019.

¹¹⁸ Source: Atlas Air.

the handling of the aircraft on the ground, loading and unloading of the flight consisted of about 12 personnel.¹¹⁹

8.3.2 Load Planning

Atlas Air cargo load planning and weight and balance computations were made via the System Automated Balance and Load Engineering (SABLE)¹²⁰ Computerized Weight and Balance system, and the SABLE system generated a weight and balance load sheet form for the flight. This load sheet was required for each flight, and two copies of the form were required to be presented and signed off by the Atlas Air captain (pilot-in-command). The load sheet contained specific limitations and configurations that were aircraft specific.

The load plan contained the cargo positions, gross weight and destination information for ground crews performing loading and offloading procedures.

ALL WEIGHTS IN LB

----- MAIN DECK -----																
	A1	2	3	4	5	6	7	8	9	10	11	12	A13			
R	0	0	0	0	0	0	0	0	0	2350	1440	1740				
C													2780			
L		220	0	0	0	0	0	0	0	0	2300	2070				
IDX	0.00	-0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74	5.93	7.64	6.57			
----- LOWER DECK -----																
	11	12	13	14	21	22	23	24	31	32	33	34	41	42	43	5
	276	234	1608	1788	360	1606	1588	1836	234	234	231	234	1284	670	850	0
IDX	-0.65	-0.50	-3.09	-3.03	-0.54	-2.06	-1.71	-1.60	0.13	0.17	0.22	0.27	1.73	1.04	1.50	0.00

Figure 4: Cargo load distribution for the accident flight.¹²¹

8.3.3 Cargo Compartments and Loads

The B-767-300BCF had 4 cargo compartments; the main deck cargo compartment, the forward cargo compartment, the aft cargo compartment, and the bulk cargo compartment.

¹¹⁹ For additional information, see Attachment 6 - StratAir Employee Statements and Attachment 7 - National Airport Services (NAS) Employee Statements.

¹²⁰ SABLE was a front-end user application developed in 2002 by third party provider Rekencentra.

¹²¹ See Attachment 8 - Atlas Air 3591 Weight and Balance.

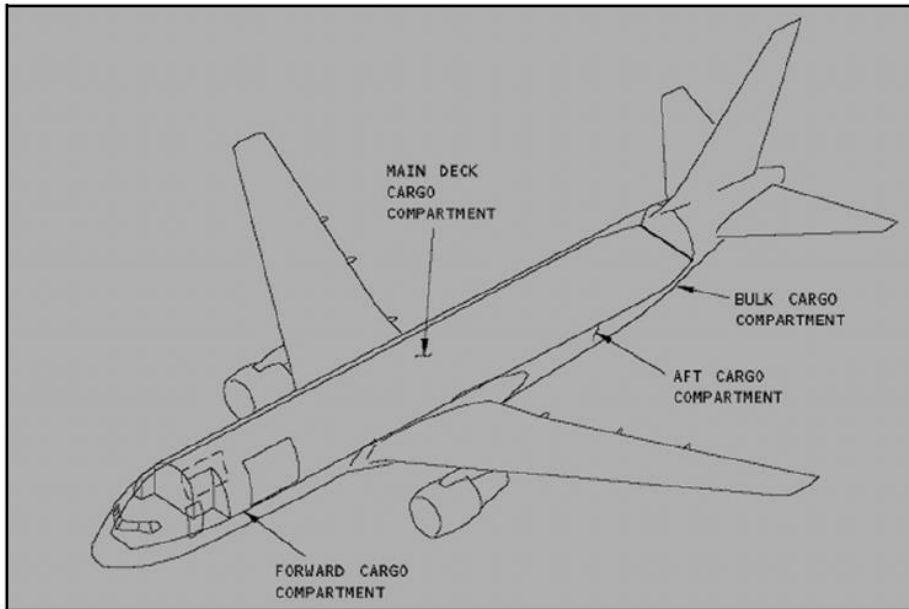


Figure 5: B-767-300BCF Cargo Compartment Configuration.¹²²

The B-767-300 main deck cargo compartment was a Class E compartment¹²³ which was loaded using the main deck side cargo door. The main deck compartment could carry pallets and containers. The floor load limit for the entire main cargo deck was 250 pounds/square foot.

Access to the main cargo deck from the cockpit was accomplished via a cargo area access door in the aft portion of the cockpit, provided no cargo was loaded and secured in the forward main cargo deck positions. According to the Atlas Air Weight and Balance Manual, supernumeraries were prohibited from entering the Class E cargo compartment during aircraft movement, except as directed by the flight crew in an emergency.¹²⁴

¹²² Source: Atlas Air Weight and Balance Manual, page 5.4.1.

¹²³ According to 14 *CFR* 25.857, for Class E cargo compartments (1) There is a separate approved smoke or fire detector system to give warning at the pilot or flight engineer station; (2) There are means to shut off the ventilating airflow to, or within, the compartment, and the controls for these means are accessible to the flight crew in the crew compartment; (3) There are means to exclude hazardous quantities of smoke, flames, or noxious gases, from the flight crew compartment; and (4) The required crew emergency exits are accessible under any cargo loading condition.

¹²⁴ Source: Atlas Air Weight and Balance Manual, page 5.2.5.



Photo 5: Main deck cargo compartment (looking forward) showing the cargo area access door to the flight deck on the left.¹²⁵

¹²⁵ Photo excerpted from the Atlas Air Weight and Balance Manual, page 2.6.14.



Photo 6: B-767-300BCF Main Deck Cargo Compartment.¹²⁶

The main deck of the accident airplane was loaded with seven (7) PAG and PAJ standard pallets.¹²⁷ One (1) empty pallet weighing 220 pounds was located in the forward main deck (position A2 left),¹²⁸ and six (6) pallets were located in the aft section of the main deck (positions A10 through A13). The pallets loaded in the aft portion of the main deck contained 45" x 60" Gaylord cardboard boxes secured to each pallet by netting. Each Gaylord contained contracted cargo from Amazon Prime. The total weight of the cargo on the main deck was 12,900 pounds.

¹²⁶ Photo excerpted from the Atlas Air Weight and Balance Manual, page 2.6.13.

¹²⁷ PAG and PAJ pallet dimensions are typically 88"x125". On all Amazon Air flights flown by Atlas Air, Amazon owned the pallets and nets used on the main cargo deck.

¹²⁸ The location of the empty pallet in position A2 left on the main deck would have allowed the flight crew access to the main deck via the cargo area access door in the aft portion of the cockpit.



Photo 7: Sample Amazon Air load including palletized Gaylord boxes.¹²⁹

The B-767-300 forward and aft cargo compartments and bulk cargo compartment below the main cargo deck were Class C compartments.¹³⁰ Fire resistant compartment linings covered the insulation blankets above the cargo floor. The floor load limit for the lower forward and aft cargo compartments was 200 pounds/square foot.

¹²⁹ Photo taken by NTSB investigators on February 27, 2019.

¹³⁰ According to 14 *CFR* 25.857, for Class C cargo compartments (1) There is a separate approved smoke detector or fire detector system to give warning at the pilot or flight engineer station; (2) There is an approved built-in fire extinguishing or suppression system controllable from the cockpit. (3) There are means to exclude hazardous quantities of smoke, flames, or extinguishing agent, from any compartment occupied by the crew or passengers; (4) There are means to control ventilation and drafts within the compartment so that the extinguishing agent used can control any fire that may start within the compartment.

Figure 2.6.20. B767-300SF Forward Lower Deck Compartment



Figure 2.6.21. B767-300SF AFT Lower Deck Compartment



Photo 8: B-767-300BCF Lower Deck Cargo Compartment.¹³¹

Cargo loaded in the bulk compartment was placed directly on the aircraft floor. Consequently, the floor load limit for the bulk cargo compartment was 150 pounds/square foot. Bulk cargo was required to be properly secured and restrained by nets and/or straps, as appropriate. For the accident flight, there was no cargo loaded in the bulk cargo compartment

On the accident flight, the lower cargo compartments were loaded with a total of fifteen (15) DQF (IATA code) Unit Load Device (ULD)¹³² containers. There were eight (8) ULDs in the forward cargo compartment with a combined weight of 9,296 pounds, and there were seven (7) ULDs in the aft cargo compartment for combined weight of 3,737 pounds. The total weight of the forward, aft and bulk compartments was 13,033 pounds.

¹³¹ Photos excerpted from the Atlas Air Weight and Balance Manual, page 2.6.15.

¹³² A Unit Load Device (ULD) was a device for grouping and retaining cargo for transit. The ULD can refer to a pallet and net, a pallet and net over and igloo, or a container.



Photo 9: Photo of sample DQF containers used in the lower cargo compartment on a B-767.¹³³

Seven (7) of the ULDs contained mail for the United States Parcel Service (USPS); 6 located in the forward cargo compartment and one (1) in the aft cargo compartment.

THS Facility		MIA			
Planned 105% Origin Cube		A1: 1,008 Charter: 0			
Actual Cube Tendered		A1: 1,764 Charter: 0			
Total Weight Tendered (lbs)		8,348			
Cube Density		4.73			
Total Voided ULDs		0			
ULD#	WGT	TARE	NET	DEST	REMARKS
DQF0818	1,284	234	1,050	IAH	
DQF0702	1,788	234	1,554	IAH	
DQF1112	1,588	234	1,354	IAH	
DQF8369	1,836	276	1,560	IAH	
DQF11457	1,608	276	1,332	IAH	
DQF1472	1,606	234	1,372	IAH	
DQF0262	360	234	126	IAH	LAST CAN
			0		
			0		
			0		
			0		

Figure 6: USPS Mail loaded on the lower deck cargo compartment on the accident flight.¹³⁴

8.3.4 Maximum Allowable Cargo Loads

There were five basic structural limitations which must be observed when loading payload, they were: compartment, linear floor, floor loading, net loading and cumulative load limitations. The maximum allowable compartment weights, maximum linear and floor loading limits for the B-

¹³³ Photo taken by NTSB investigators on February 27, 2019.

¹³⁴ Source: Email to the NTSB from the Team Leader – Security, Houston Division, U.S. Postal Inspection Service on February 27, 2019.

767-300BCF are provided in the following table. The total cargo weight on the main deck was 12,900 pounds, and the total cargo weight in the lower cargo compartments (forward, aft and bulk) was 13,033 pounds (9,296 forward and 3,737 aft).

Table 5.4.1. Maximum Allowable Weights

COMPARTMENT	MAXIMUM ALLOWABLE WEIGHT					
	TOTAL WEIGHT		FLOOR LOADING			
	LB	KG	LB/IN.	KG/IN.	LB/SQ FT	KG/SQ FT
Main Deck Cargo ^[a]						
B.A. 158.0 to B.A. 247.0	4570	2072	52.0	23.5	250.0 ^[b]	113.3 ^[b]
B.A. 247.0 to B.A. 764.0	43945	19933	85.0	38.5	250.0 ^[b]	113.3 ^[b]
B.A. 764.0 to B.A. 1065.0	36120	16383	120.0	54.4	250.0 ^[b]	113.3 ^[b]
B.A. 1065.0 to B.A. 1644.0	49130	22284				
B.A. 1065.0 to B.A. 1639.0	48790	22130	85.0	38.5	250.0 ^[b]	113.3 ^[b]
B.A. 1639.0 to B.A. 1644.0	340	154	68.0	30.8	250.0 ^[b]	113.3 ^[b]
B.A. 1644.0 to B.A. 1732.0	4300	1950	49.0	22.2	250.0 ^[b]	113.3 ^[b]
Forward Cargo Hold ^[c]						
B.A. 234.7 to B.A. 743.6	45000 ^[d]	20411 ^[d]	90.0 ^[e]	40.8 ^[e]	200.0	90.7
Aft Cargo Hold ^{[c][f]}						
B.A. 1085.2 to B.A. 1543.0	38745 ^[g]	17574	90.0	40.8	200.0	90.7
Bulk Hold ^[f]						
B.A. 1543.0 to B.A. 1672.0	6450 ^[h]	2925 ^[h]	50.0	22.6	150.0	68.0

- A. The main deck limitations include the weight of cargo and the unit load devices (ULDs).
- B. Capability of the main deck cargo handling system to support concentrated loads. The main deck floor panels have a maximum loading capability of 100 LB/SQ FT (45.4 KG/SQ FT).
- C. The lower hold limitations include the weight of cargo and the unit load devices (ULDs).
- D. Capability can be increased to 134.0 LB/IN (60.7 KG/IN) provided all weight above 90.0 LB/IN (40.8 KG/IN) is tied down.
- E. If the barrier net that separates the aft cargo hold from the bulk cargo hold is damaged or not installed refer to MEL for operation limitations.
- F. The maximum load limit is 37800 LB (17145 KG) with non-approved ULDs or bulk cargo.
- G. The bulk cargo net at B.A. 1543.0 must be installed. Otherwise the maximum allowable weight in the bulk hold is 0 LB (0KG) or the Bulk Hold Cargo must be tied down. If the B.A. 1543.0 net is damaged or not installed refer to MEL for operation limitations.

Figure 7: B-767-300BCF Maximum Allowable Weights.¹³⁵

8.3.5 Cargo Restraint System

Cargo restraint involved the prevention of movement in four principal directions: forward, aft vertical and lateral (left and right). These movements are the result of forces exerted upon the cargo during takeoff and landing, as well as forces due to air turbulence encountered in flight. Such forces are commonly expressed in terms of gravitational units (G's). The restraint system includes all bulkheads, latches, locks, 9G nets, rails, and stops in the cargo compartment and belly of the aircraft. The restraint required for flight and taxi load was 1.5 G's forward, aft and lateral restraint, and -3.0 G's vertical restraint.

The B-767-300BCF main cargo deck floor contained floor lock assemblies designed to provide restraint for ULDs in certain cargo loading configurations. According to cargo loader interviews and statements, procedurally upon completion of loading and securing of the main deck cargo pallets and/or ULDs, all unused floor lock assemblies on the main deck were placed in the up position as an additional safety measure to mitigate the likelihood of a cargo shift.

¹³⁵ Source: Atlas Air Weight and Balance Manual, page 5.4.2.



Photo 10: Photo of B-767 exemplar airplane showing main cargo deck floor and floor lock assemblies.¹³⁶



Photo 11: Close-up photo of B-767 exemplar airplane showing main cargo deck floor lock assembly (down and unlocked position).¹³⁷

¹³⁶ Photo taken of exemplar B-767 by NTSB investigators on February 27, 2019.

¹³⁷ Photo taken of exemplar B-767 by NTSB investigators on February 27, 2019.



Photo 12: Close-up photo of B-767 exemplar airplane showing main cargo deck floor lock assembly (up and locked position).¹³⁸

9.0 Meteorological Information¹³⁹

9.1 George Bush Intercontinental/Houston Airport (IAH) METARS¹⁴⁰

KIAH 231713Z 32018G24KT 8SM BR SCT016 BKN020 BKN029 19/12 A2991 RMK AO2 PK
WND 33029/1701 WSHFT 1653 RAB01E13 VCSH SE-S
P0000 T01940122

KIAH 231753Z 32014G19KT 9SM FEW020 SCT033 BKN060 21/12 A2992 RMK AO2 PK
WND 33029/1701 WSHFT 1653 RAB01E13 SLP131 P0000 60000 T02110122 10261 20189
53015

KIAH 231802Z 32015G24KT 10SM FEW035 SCT060 BKN080 BKN250 22/12 A2992 RMK
AO2 T02220117

Accident occurred at 1839

¹³⁸ Photo taken of exemplar B-767 by NTSB investigators on February 27, 2019.

¹³⁹ For more detailed weather information, see Meteorology Group Chairman's Factual Report in the docket for this accident.

¹⁴⁰ Meteorological Terminal Aviation Routine Weather Reports or Meteorological Aerodrome Reports (METARs) are taken manually by NWS, FAA, contractors, or supplemental observers. METAR reports are also provided by Automated Weather Observing System (AWOS), Automated Surface Observing System (ASOS), and Automated Weather Sensor System (AWSS). Source: AIM 7-1-1. IAH was located approximately 34 nautical miles from the accident site.

KIAH 231853Z 32011G19KT 10SM SCT035 BKN080 BKN250 21/12 A2991 RMK AO2
SLP129 T02110117

9.2 William P. Hobby Airport (HOU) METARS¹⁴¹

KHOU 231753Z 31015G25KT 10SM -RA FEW018 BKN025 BKN036 21/15 A2990 RMK AO2
PK WND 28034/1742 WSHFT 1737 RAB23 SLP128 FROPA
VCSH NE P0002 60002 T02110150 10256 20211 53009

10.0 Airport Information

The accident flight was a scheduled cargo flight between MIA and George Bush Intercontinental/Houston Airport (IAH), which was located 15 miles to the north of Houston, Texas at an elevation of 95.8 feet above sea level (latitude/longitude 29-59-03.9670N / 095-20-29.1930W).¹⁴²

¹⁴¹ HOU was located approximately 30 nautical miles west of the accident site.

¹⁴² According to the Atlas-Southern FOM, page 5.1.4, and Atlas Air OpSpecs C050, IAH did not require a Special PIC Qualification required under 14 *CFR* 121.445.

10.1 Airport Chart

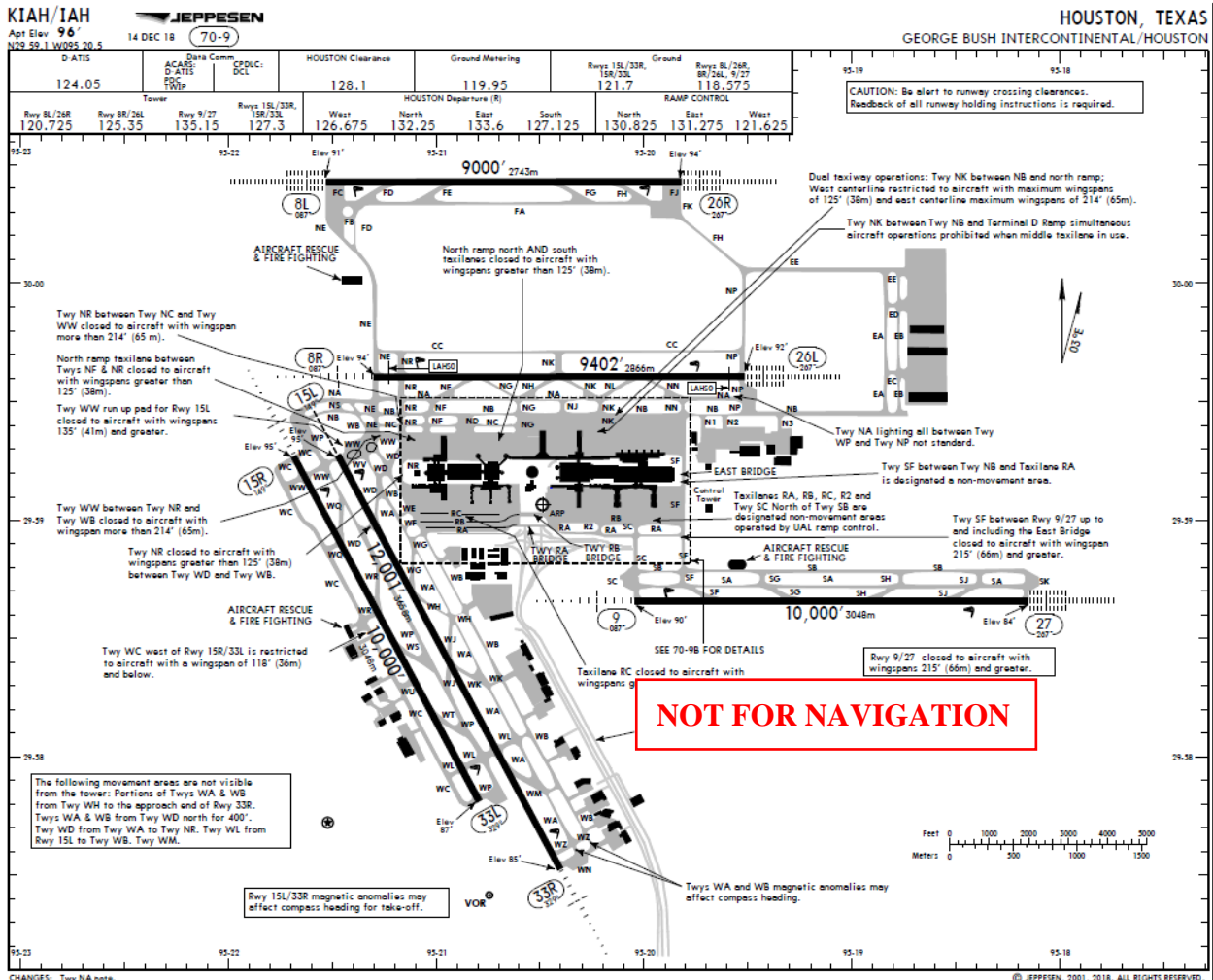


Figure 8: Jeppesen 70-9 IAH Airport Chart.

10.2 IAH LINKK One RNAV Arrival

According to its flight plan, GTI3591 was originally cleared to IAH via the NNCEE1 arrival into IAH from the GIRLY intersection. About 1759, GTI3591 checked on with White Lake Ultra High (LLA-UH), and was provided revised routing to IAH after the GIRLY intersection, and the controller cleared the flight to IAH via the LINKK1 arrival.

About 1818, the GTI3591 was cleared to descend via the LINNK One RNAV arrival into IAH, and at 1825, GTI3591 advised the controller they were beginning their descent on that arrival.

10.2.1 IAH LINKK One RNAV Arrival Chart

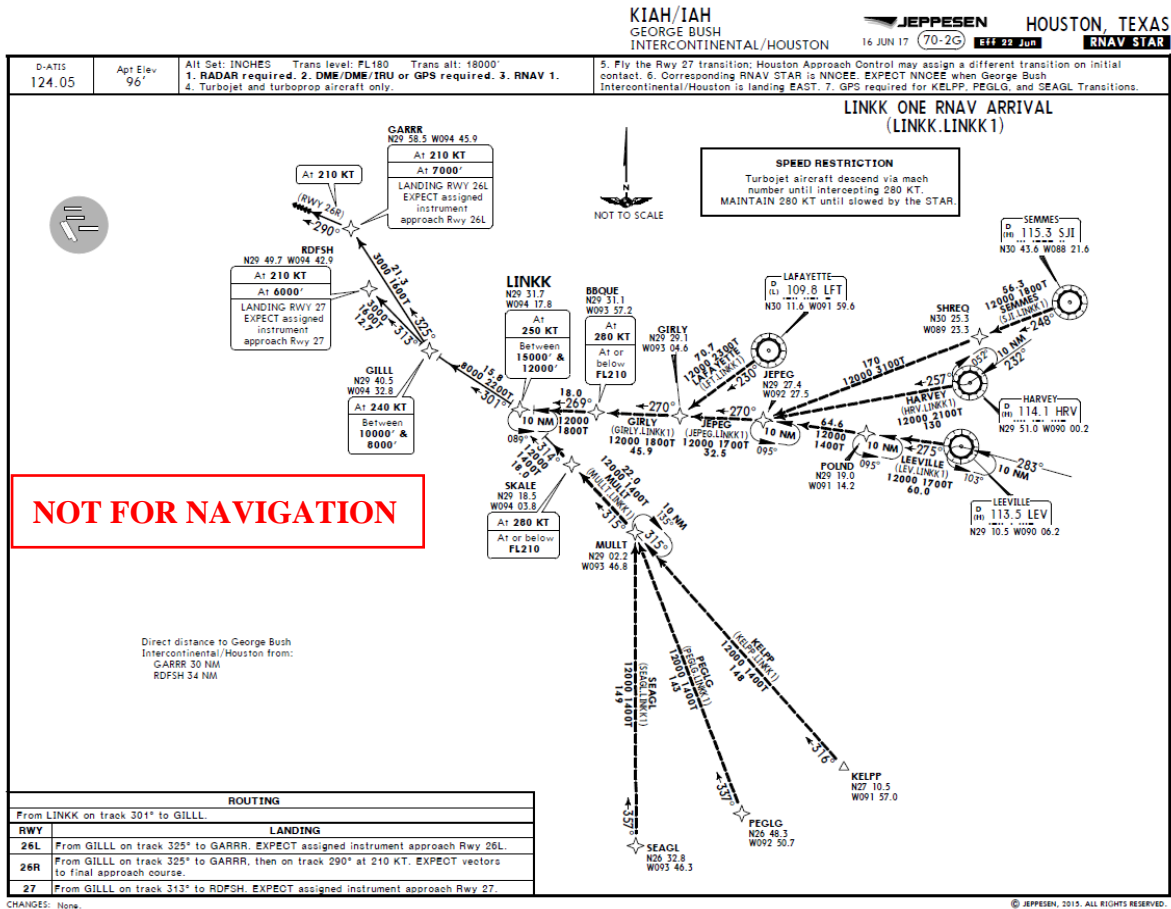


Figure 9: Jeppesen 70-2G IAH LINNK One RNAV Arrival Chart.

10.3 IAH Runway 26L

About 1835, GTI3591 checked on with the final ATC controller and was told to expect vectors to runway 26L at IAH. Runway 26L was a 9,402 feet long and 150 feet wide concrete grooved runway at an elevation of 94.3 feet above mean sea level. It had high intensity runway edge lights, a medium intensity approach lighting system (MALSR) with runway alignment indicator lights. The runway was serviced by an instrument landing system (ILS) with distance measuring equipment (DME) capability.

10.3.1 ILS Runway 26L Approach Chart

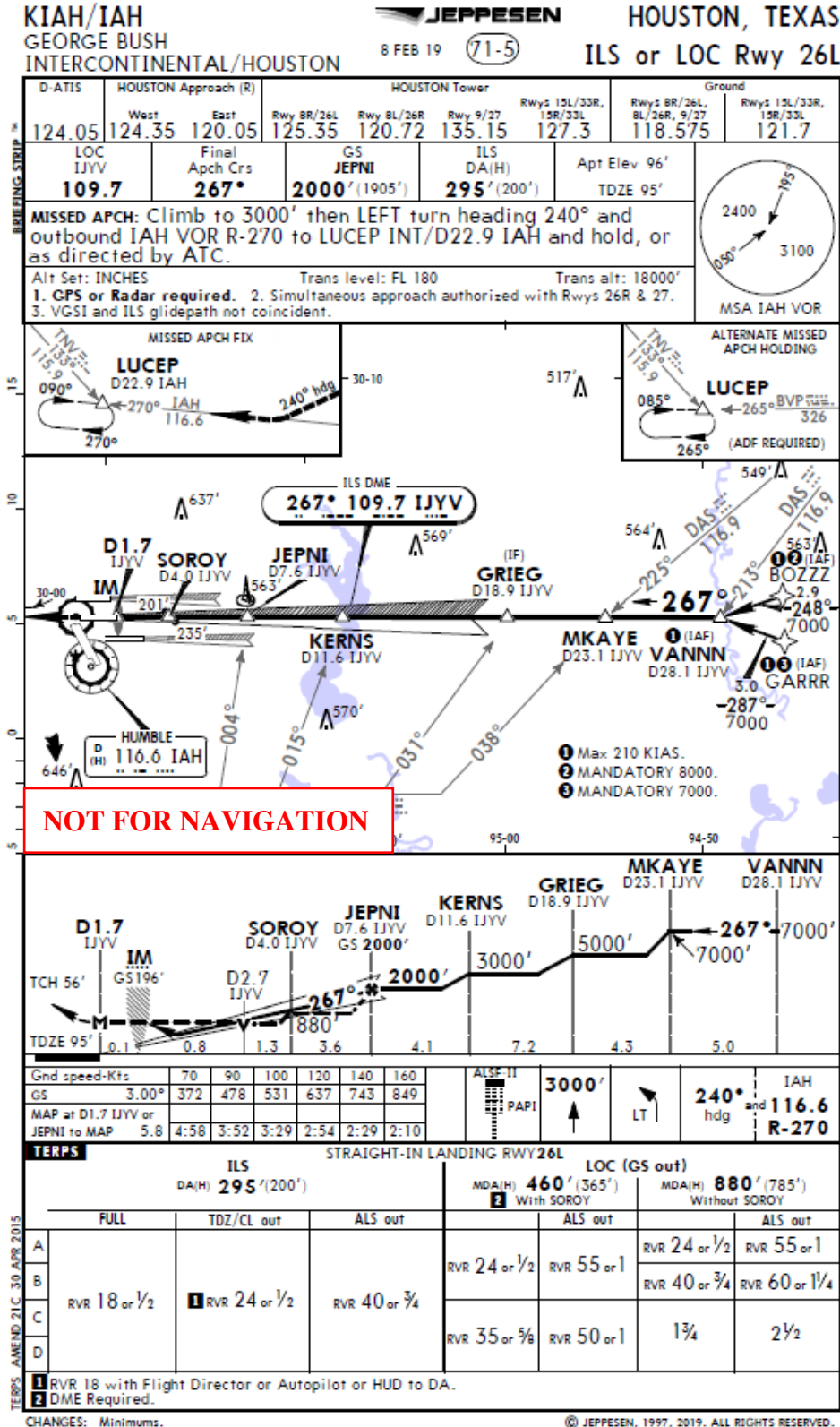


Figure 10: Jeppesen IAH 71-5 ILS 26L approach chart.

11.0 Atlas Air Company Information

Atlas Air, Inc. began operations in the early 1990's leasing freighter aircraft to other airlines on an Aircraft, Crew, Maintenance and Insurance (ACMI) contract basis. According to its OpSpecs, Atlas Air (Air Carrier certificate number UIEA784U issued February 23, 1993) was authorized per 14 *CFR* 119.21(a) to conduct flag, domestic and supplemental operations under 14 *CFR* Part 121. Initial operations began by using a Boeing 747-200. By the end of 2000, the Atlas Air fleet had grown to 36 aircraft.

Atlas Air acquired Polar Air Cargo in November 2001. Subsequently, Atlas Air Worldwide Holdings (AAWH) was created as a holding company for both certificates while the airlines continued to operate separately after DHL Aviation (a division of DHL Express and owned by Deutsche Post) took a 49% interest in Polar Air Cargo. AAWH was listed on the NASDAQ stock exchange, and in 2010 Atlas Air began passenger charter operations with B-747-400 and B-767-300 aircraft.

Both Atlas Air and Polar Air Cargo certificates continue to operate independently with their own management structure, Part 119 post holders, and Board of Directors. However, Atlas Air and Polar Air Cargo have shared a single crew force since March 2012.

In April 2016, AAWH acquired Southern Holdings which had two certificates: Southern Air and Florida West, and AAWH was in the process of integrating Southern into Atlas Air. Florida West, which operated a several B-767's in an interchange agreement with LAN Airlines (now LATAM Airlines following the merger of LAN Airlines and TAM Airlines in 2012), was shut down in early 2017.

According to information provided by Atlas Air, Atlas Air and Polar Air and Southern Air had separate reporting systems with several exceptions:

- Atlas and Polar had a single Aviation Safety Action Program (ASAP)¹⁴³ program between the two (same crew force). Southern had a separate work force and its own separate ASAP's.
- All three certificates (Atlas Air, Polar and Southern) shared some functions such as their flight data monitor (FDM)¹⁴⁴ analysis, and internal audits.¹⁴⁵

¹⁴³ According to the FAA AC 120-66B *Aviation Safety Action Program (ASAP)*, the objective of the ASAP is to encourage air carrier and repair station employees to voluntarily report safety information that may be critical to identifying potential precursors to accidents. The Federal Aviation Administration (FAA) has determined that identifying these precursors is essential to further reducing the already low accident rate. Under an ASAP, safety issues are resolved through corrective action rather than through punishment or discipline. The ASAP provides for the collection, analysis, and retention of the safety data that is obtained. ASAP safety data, much of which would otherwise be unobtainable, is used to develop corrective actions for identified safety concerns, and to educate the appropriate parties to prevent a reoccurrence of the same type of safety event.

¹⁴⁴ FDM is a system capable of recording flight performance data.

¹⁴⁵ Source: Email to the NTSB from the Atlas Air Vice President Safety and Regulatory Compliance on Monday, June 17, 2019 9:39am.

Atlas Air pilots were covered under a collective bargaining agreement between Atlas Air and the IBT Airline Division since December 22, 2008. Their current contract (dated September 8, 2011) was being renegotiated at the time of the accident.

Atlas Air pilots were covered under their own ASAP program. At the time of the accident, Atlas Air did not have a formal Flight Operational Quality Assurance (FOQA)¹⁴⁶ program and was working to establish a FOQA program within its contract negotiations with the pilot's union, but according to the Atlas Air B-747/767 Fleet Captain, the airline utilized data from FDMs for inclusion in its current CRM training curriculum.¹⁴⁷ Atlas Air also had not conducted a Line Operations Safety Audit (LOSA)¹⁴⁸ of its operations. Atlas Air has been listed on the International Air Transport Association (IATA) Operational Safety Audit (IOSA) registry since 2007. In addition, Atlas Air had a formal Safety Management System (SMS) program contained in the Atlas Air Safety and Regulatory Compliance Manual (SRCM), which was the primary source of all SMS policies, procedures and processes used by Atlas Air.¹⁴⁹ According to its website, the following were elements of the Atlas Air safety structure:¹⁵⁰

- Oversight of all operating departments
- Formal, proactive methods for identifying hazards and mitigating risks
- Comprehensive Safety Reporting tools
 - Constant quality assurance and control reporting
 - Accepted Aviation Safety Action Programs (ASAP)
- Safety Technology
 - Continued investment in leading technologies such as
 - Wireless Quick Access Recorders (WQARs)
 - Flight Data analysis and visualization
 - Emergency Vision Assurance System (EVAS)
 - AEDs on all ETOPS aircraft
 - Lithium battery fire containment products
 - Continuous feedback of safety performance data to all operating departments and the management team
 - Continued investment in training, education, and awareness throughout the organization

¹⁴⁶ FOQA is a voluntary safety program designed to improve aviation safety through the proactive use of flight recorded data. Source: FAA.

¹⁴⁷ See Attachment 22 – Atlas CRM Training Presentation.

¹⁴⁸ LOSA uses trained peer observers to collect data about flight crew behavior and situational factors on normal flights. The audits are no-jeopardy, and potential threats to safety, errors, and the crew's reactions as part of an overall CRM threat and error management review of the operation. Operator participation in LOSA is voluntary.

¹⁴⁹ Source: Atlas-Southern FOM, page 11.1.13. According to the FAA AC 120-92B *Safety Management Systems for Aviation Service Providers*, provides information for Title 14 *CFR* Part 121 air carriers that are required to implement Safety Management Systems (SMS) based on 14 *CFR* Part 5. Specifically, this document provided a description of regulatory requirements, guidance, and methods of developing and implementing an SMS. An SMS is an organization-wide comprehensive and preventive approach to managing safety, and includes a safety policy, formal methods for identifying hazards and mitigating risk, and promotion of a positive safety culture. An SMS also provides assurance of the overall safety performance of an organization.

¹⁵⁰ Source: <https://www.atlasair.com/about-us/safety-and-compliance/>.

The Atlas Air corporate headquarters were located in Purchase, New York. The company had 2,922 total employees, and 1,755 flight crewmembers based in the following crew bases; Anchorage, Alaska (ANC); Miami, Florida (MIA); Huntsville, Alabama (HSV); Chicago, Illinois (ORD); New York, New York (JFK); Los Angeles, California (LAX); Covington, Kentucky (CVG); Ontario, California (ONT); Everett, Washington (PAE).

The airline operated 83 total aircraft, including thirty-three (33) B-747-400's, four (4) B-747-8F's, ten (10) B-767-200, and twenty-six (26) B-767-300's.¹⁵¹

The Atlas Air safety culture was described in the Atlas-Southern FOM. The FOM, page 11.1.1 stated the following, in part:

The Company relies on the pilot's adherence to the published standards and procedures necessary in today's highly complex operational environment. Adherence to standards alone is insufficient. An integrated, cohesive Flight Deck Crew engaging in proven Threat and Error Management risk countermeasure behaviors is required in order to continuously minimize operational exposure to risk.

The five stated goals of Company operations, in order of priority, are:

- 1. Safety*
- 2. Regulatory Compliance*
- 3. Passenger comfort*
- 4. Schedule Performance*
- 5. Efficiency*

11.1 Flight Data Monitoring

The Atlas Air Flight Data Monitoring (FDM) Program was defined in the Atlas-Polar-Southern SRCM (version 12, dated February 11, 2019). According to the manual, FDM was defined as a program to improve flight safety by providing more information about, and greater insight into, the total flight operations environment through selective automated recording and analysis of data generated during flight operations. The FDM program assisted Atlas Air in identifying and addressing operational deficiencies and trends that were not generally detectable with other procedures.

The FDM program at Atlas Air was managed by the Safety Regulatory Compliance (SRC) Department. Final authority and oversight of the FDM program at Atlas Air resided with the Vice President, Safety Regulatory Compliance. Daily management of the program was delegated to the FDM Program Manager.

With the acquisition of Southern Air by Atlas Air in April 2016, both airlines' FDM programs were aligned, which was completed in June 2017. The former Southern FDM Program Manager then took over the combined FDM program (Atlas Air, Polar and Southern) to allow the former

¹⁵¹ Source: Atlas Air Vice President Safety and Regulatory Compliance.

Atlas FDM Program Manager time to work on the Atlas Air/Southern single operating certificate (SOC) process.

According to an email sent from Atlas Air to the NTSB,¹⁵² prior to the accident the company had not received any safety reports describing inadvertent activation of the go-around mode on the B-767, nor have they received any reports following the accident. When asked if Atlas was monitoring any performance indicators as part of the FDM program that would have flagged inadvertent activation of the go around mode on the 767, Atlas Air responded that FDM would show activation but not the reason for activation. Only ASAP reports or internal Flight Crew Reports (FCR) would tell whether an activation was inadvertent.

No ASAP or FCR reports had been received by Atlas Air indicating inadvertent activation of the go-around mode was an issue. When asked whether the Atlas FDM program was capable of identifying patterns of performance deficiencies among Atlas Air crewmembers on the line, Atlas Air responded “the FDM program identifies aggregate patterns such as unstable approaches, flap overspeeds, hard landings etc., but does not score overall performance down to a specific crewmember. For instance, an airport receives an FDM rate for unstable approaches, but an individual crewmember is not assigned an unstable approach rate to be compared amongst their peers. Should a crewmember however exhibit a performance deficiency resulting in an incident, an ERB (Event Review Board) would be convened by Safety and Regulatory Compliance (SRC) to investigate the root cause of the deficiency and develop preventive measures including the retraining of a particular crewmember.”

11.1.1 Airborne Data Acquisition System

The FDM program was scheduled to monitor all aircraft in the Atlas Air fleet. The company utilized a variety of Quick Access Recorders (QARs) to collect flight data from the aircraft. QARs were a recording unit onboard the aircraft that were designed to provide quick and easy access to a removable medium, such as a Personal Computer Memory Card International Association (PCMCIA) disk. Flight data from the QAR could also be transmitted wirelessly in place of a PCMCIA card, known as a Wireless QAR (WQAR), which allowed the flight data to be sent via cellular networks moments after a flight was completed. The data from the QAR for N1217A following its arrival into MIA on the day of the accident was provided by Atlas Air and delivered to the NTSB Research and Engineering (RE) division.¹⁵³

Data from the QAR uploaded to the Atlas Air Ground Data Replay and Analysis System (GDRAS) was processed to identify specific events. An event was an occurrence or condition in which pre-determined limits of aircraft parameters had been exceeded. Events represented the conditions to be tracked and monitored during various phases of flight and were based on sensory data parameters available on a specific aircraft fleet. If an event was detected through one of these definitions, it was then categorized by severity: information only, caution, warning, or alert (in that order). Alert was the most severe of the event definitions and an automatic email message was distributed to a defined list of Safety department personnel. This notification system ensured that

¹⁵² Source: Email sent by Atlas Air to the NTSB on Tuesday, October 15, 2019 10:33 AM.

¹⁵³ Source: Email sent to the NTSB from the Southern Air Director of Safety on Thursday, February 28, 2019 12:18pm.

Alert events and messages received immediate attention. An event review process ensured data entered into the GDRAS was not inaccurate (false positive).

Atlas Air used FDM data for corrective actions to include modifications to flight crew training, revisions of operating procedures, or for equipment redesign. These corrective actions were tracked and monitored by the FDM Program Manager.

FDM data was also used in other internal safety programs such as SMS and ASAP, and external 3rd party entities such as Aviation Safety Information Analysis & Sharing (ASIAS)¹⁵⁴ and Flight Data eXchange (FDX).¹⁵⁵

12.0 Relevant B-767 Systems¹⁵⁶

The Atlas Air B-767 systems information was contained in the Atlas Air/Polar B-767-200/-300 Flight Crew Operations Manual (FCOM), Volume 2 (revision number 8, dated May 22, 2018).

12.1 Electronic Flight Instrument System (EFIS)

The electronic flight instrument system (EFIS) consisted of three (L,C,R) symbol generators (SGs), two control panels (CPs) two attitude director indicators (ADIs), two horizontal situation indicators (HSIs), and ambient light sensing units. The EFIS used information provided by a variety of aircraft systems to generate the appropriate visual presentations on the HSI and ADI. The ADI presented conventional displays for attitude (pitch and roll), flight director commands, localizer deviations and glideslope deviation, information related to the autoflight system mode annunciations (flight mode annunciator – FMA), airplane speed, pitch limit, radio altitude and decision height. The HSI presented an electronically generated color display of navigations data. Each HSI was capable of displaying the airplane’s progress on a dynamic map display.

Data relating primarily to navigation was provided by aircraft systems such as the navigation radios, flight management computer (FMC), and the inertial reference systems. Data relating primarily to automatic flight was provided by the flight control computers (FCCs), the autothrottle (A/T), and the FMC. Data which was used to display current aircraft state information was provided by the two air data computers (ADCs) and the three inertial reference systems (IRSs).

¹⁵⁴ Sponsored by the FAA, ASIAS provides access to safety reports based on aggregated, de-identified analysis of data, access to peers with the aviation safety community, and access to detailed safety analysis of public operational data.

¹⁵⁵ Sponsored by IATA, FDX is an aggregated de-identified database of FDA/FOQA type events that allows the user to identify commercial flight safety issues for a wide variety of safety topics, for many types of aircraft, across a global database; as well as allow flight operations and safety departments to proactively identify safety hazards.

¹⁵⁶ This section of the Factual Report includes B-767 systems information provided to Atlas Air pilots via the Atlas/Polar B-767 FCOM Volume 2 and systems presentations provided to Atlas Air B-767 pilots during initial and recurrent training modules. For a more detailed discussion of B-767 systems information, see Systems Group Chairman’s Factual Report in the docket for this accident.

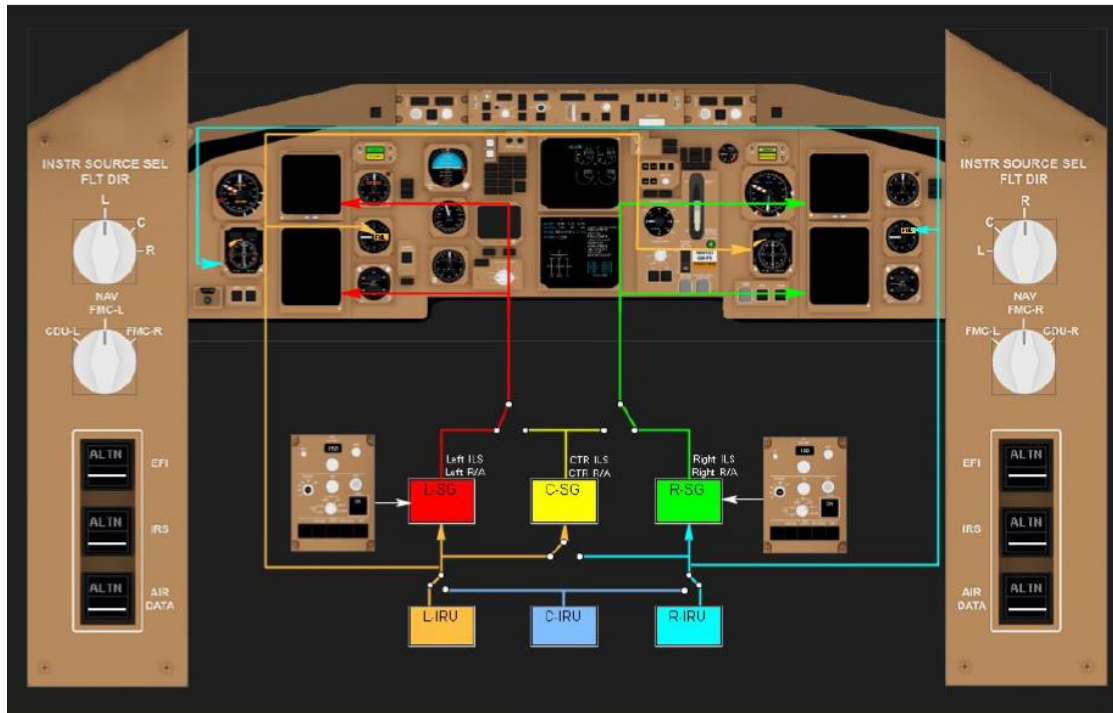


Figure 11: B-767 electronic flight instrument system (EFIS).¹⁵⁷

12.1.1 EFIS Symbol Generators

The three symbol generators (SGs) were the primary sources to the EFIS. The SGs received inputs from the various aircraft systems, then generated the proper visual displays for the related ADI and HSI. Each pilot's ADI and HSI displays were provided from the SG selected with their respective EFI switch. The left SG normally provided the captain's displays, and the right SG normally provided the FO's displays. The center SG was available as an alternate source for either or both pilots.

12.1.2 Electronic Flight Instrument (EFI) Switch

Each EFIS control panel was connected to the symbol generator with the electronic flight instrument (EFI) switch (depicted by number "1" in Figure 12 below). EFI switching determined the center symbol generator input and output. The EFI switch selected the EFIS symbol generator, ILS receiver, and radio altimeter used as the sources of information for the captain's ADI and HSI (for the left Instrument Source Selector Panel) and the FO's ADI and HSI (for the right Instrument Source Selector Panel). If the switch was blank (no white light displayed in the switch), it indicated a normal position and source information for the captain's symbol generator, ILS receiver and radio altimeter (left) and source information for the FO's symbol generator, ILS receiver and radio altimeter (right). In the alternate ALTN position (white light displayed in the switch) either pilot's displays used the center symbol generator, center ILS and center radio altimeter.

¹⁵⁷ Source: Atlas Air 767 AFDS Introduction training module. Atlas Air B-767 training modules included Powerpoint slide presentations created by CPaT.com Aviation Training Solutions.

When both pilots selected ALTN with their EFI switches, the left system instrument sources supplied data to the center symbol generator. However, the center symbol generator always used the center radio altimeter. Normally the left system instrument sources supplied the center symbol generator.

According to the Atlas Air B-767 Quick Reference Handbook (QRH), there was no defined procedure or checklist for when to use the EFI switch. The only QRH mention of the EFI switch was an informational note that illumination of the INSTR SWITCH message on the engine-indicating and crew-alerting system (EICAS) indicated that both pilot's EFI switches were in the alternate position, and both ADIs and HSIs were displaying information from the center symbol generator. According to interviews with Atlas Air B-767 instructors and check airmen, use of the EFI was trained in the simulator as a non-normal, and specifically was a suggested non-normal event used by Atlas Air check airmen during B-767 type rating check rides.

Right Instrument Source Selector Panel (Lower)

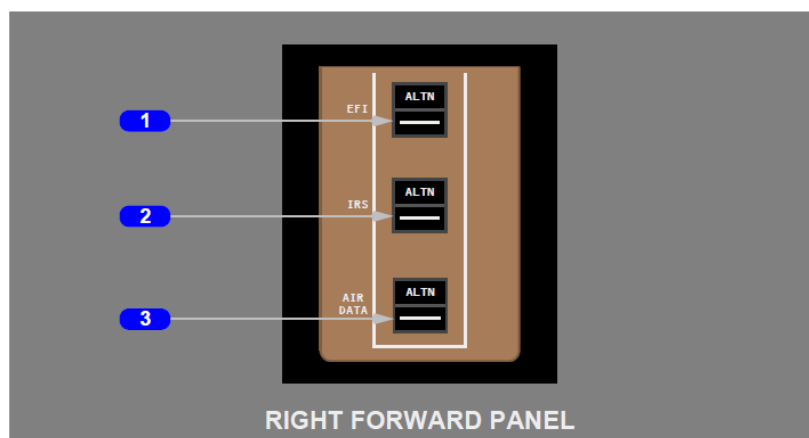


Figure 12: Right Instrument Source Selector Panel (Lower) located on the right (FO) side of the forward control panel, showing location of the EFI switch (indicated by the number “1” in the figure).¹⁵⁸

¹⁵⁸ Source: Atlas/Polar FCOM Volume 2, page 10.10.89.



Photo 13: Photo showing Right Instrument Source Selector Panel (Lower) located on the right (FO) side of the forward control panel on the accident airplane (the EFI switch is indicated by the red circle).¹⁵⁹

On June 5, 2019 the Ops Group conducted an observation plan in a B-767 simulator at the Boeing Training and Professional Services facilities in Miami, Florida, and the EFI switch and its operation were documented. For additional information, see Attachment 31 - Simulator Observation.

12.2 Autopilot Flight Director System (AFDS)

The major components of the Autopilot Flight Director System (AFDS), included the three Flight Control Computers (FCC), Thrust Management Computer (TMC), Autothrottle System (A/T), two Flight Management Computers (FMC), and the Inertial Reference System (IRS).

The AFDS may be used to fly the airplane through pilot-selected direct control inputs from the Mode Control Panel (MCP) or through the computer generated inputs from the FMCs.

¹⁵⁹ Source: Boeing March 24, 2019 email to the NTSB showing photos of N1217A following its conversion from passenger configuration to cargo configuration (date of photo unknown).

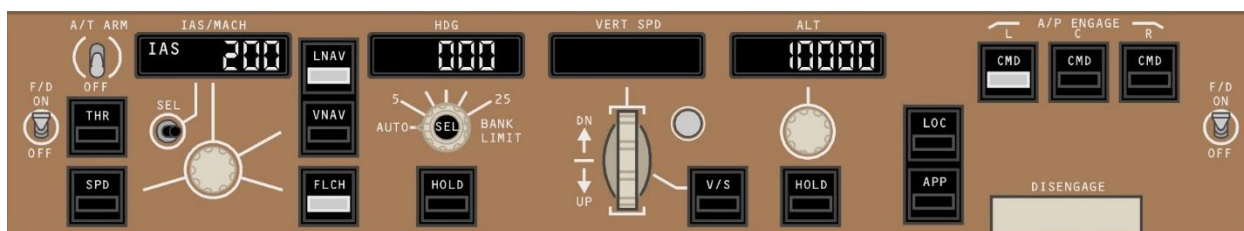


Figure 13: B-767-300 Mode Control Panel (MCP), located on the center glareshield in the cockpit.¹⁶⁰

The FMCS were capable of flying an optimized lateral and vertical flight path during climb, cruise and descent by automatically managing pitch, roll and thrust through inputs to the AFDS and A/T. The Thrust Management Computer (TMC) provided autothrottle operation throughout the flight from takeoff to landing. Other supporting components included the Control Display Unit (CDU), Electronic Flight Instrument System (EFIS), conventional flight instruments and radio navigation aids.

In most of the flight regime, the Autopilot (A/P) operated only the ailerons and the elevators. Rudder was only added during a multi-A/P approach, in which case it also extended to provide nose wheel steering during rollout from an automatic landing. Depending on configuration, autopilot engagement required either one or two FCCs and pressing one of the MCP autopilot engage switches. Only one autopilot was available in flight before Autoland. Thereafter, all three autopilots flew the airplane during the approach, landing and rollout.

Normal autopilot disengagement was through either control wheel autopilot disengage switch. The autopilots could also be disengaged by the MCP autopilot disengage bar. The A/P DISC illuminates and the EICAS warning message AUTOPILOT DISC would display with disengagement (manually or automatically).

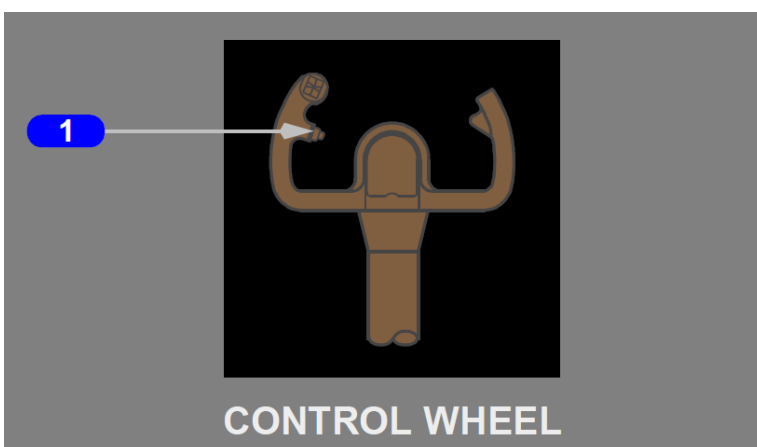


Figure 14: B-767 Autopilot Disengage Switch (indicated by the number “1” in the figure).¹⁶¹

According to FDR data for the accident flight, the autopilot remained engaged during the entire accident sequence and to final impact with terrain.

¹⁶⁰ Source: Atlas Air 767 AFDS Introduction (Recurrent) training module (CPaT.com Aviation Training Solutions).

¹⁶¹ Source: Atlas/Polar B-767 FCOM Volume 2, page 4.10.24.



Figure 15: B-767-300 Autopilot disengagement alerts.¹⁶²

The Atlas Air 767 AFDS Introduction (Recurrent) training module contained a note that stated the following:

If unwanted operation is noticed or when an autopilot failure is annunciated, the autopilot should be disconnected and the airplane flown manually.

According to Boeing, a forced applied to the control column with the autopilot connected will not disengage the autopilot on the B-767-300.¹⁶³

12.2.1 Flight Mode Annunciator (FMA)

The autoflight flight mode annunciations were provided in the ADIs. The FMA displayed information from left to right pertaining to:

- Autothrottle Mode
- Pitch
- Roll
- AFDS Status

Active modes were displayed in large green letters in the top part of the annunciator windows. Armed modes were indicated in smaller, white letters underneath the green annunciations. Exceptions to these indications are the TO on the ground and GA in flight. Modes that became active when selected include: FLCH, VNAN, THR, SPD, HDG HLD, HDG SEL, V/S, ALT HLD. Modes that were normally armed before becoming active are: LNAV, LOC, APP. In general, all modes could be cancelled or disengaged by selecting another mode.

¹⁶² Source: Atlas Air 767 AFDS Introduction (Recurrent) training module (CPaT.com Aviation Training Solutions).

¹⁶³ For additional information, see Systems Group Chairman's Factual report in the public docket for this accident.

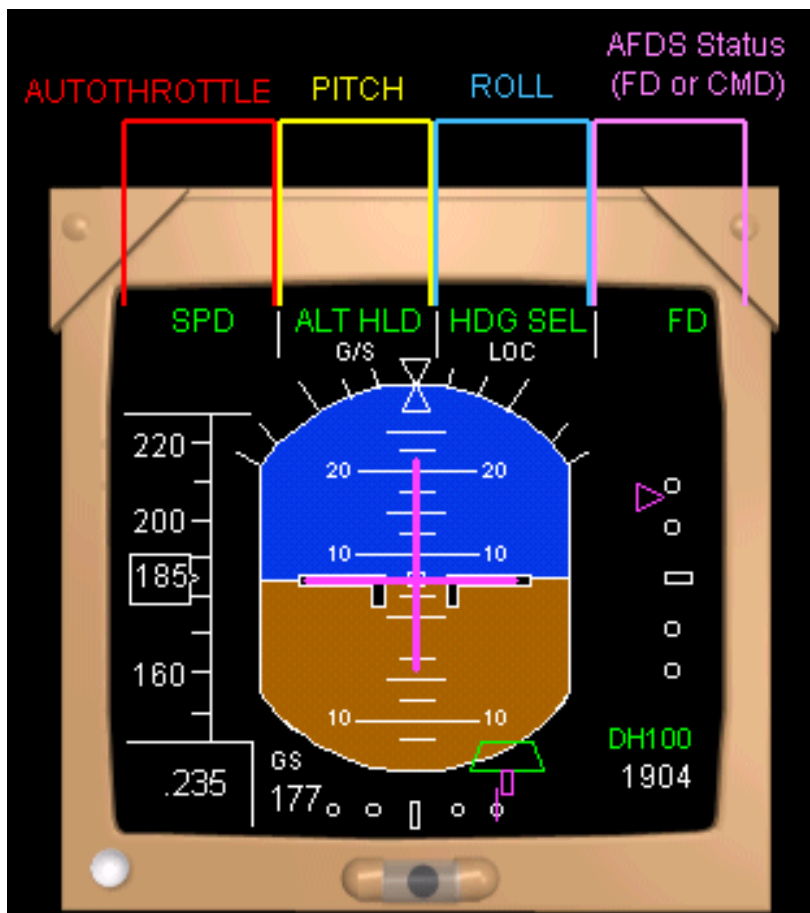


Figure 16: Flight Mode Annunciator.¹⁶⁴

12.1 Autothrust

The thrust management computer (TMC) controlled the autothrottle system through manual inputs from the MCP or automatically from the FMCs while VNAV was engaged. The basic TMC functions were to:

- calculate thrust limit and settings or follow FMC thrust settings
- detect and transmit autothrottle failures
- actuate the thrust levers

The autothrottle system provided thrust control from takeoff through landing. Autothrottle mode and speed selection was controlled from the MCP and the thrust mode select panel (TMSP). The autothrottle could be operated without using the flight director or the autopilot.

The thrust levers could be manually positioned without disconnecting the autothrottle. After manual positioning and release, the autothrottle repositioned the thrust levers to comply with the engaged mode.

¹⁶⁴ Source: Atlas Air 767 AFDS Introduction training module (CPaT.com Aviation Training Solutions).

The autothrottle system could be disconnected manually by positioning the A/T arm switch on the glareshield to OFF, or by pushing either thrust lever A/T disconnect switch. Autothrottle disconnect occurred if a fault in the active autothrottle mode was detected, or when a reverse thrust lever was raised to reverse idle. The A/T DISC light illuminated and the EICAS caution message AUTOTHROT DISC displayed when the autothrottle is disconnected.

According to FDR data for the accident flight, the autothrust remained engaged during the entire accident sequence and to final impact with terrain.

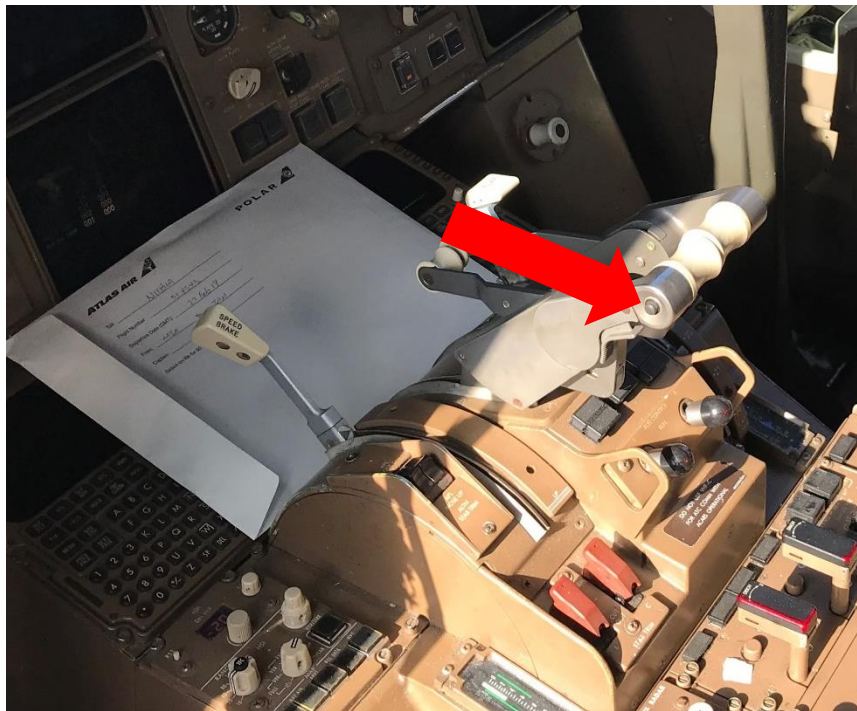


Photo 14: Photo of exemplar B-767 showing location of the autothrottle disconnect switches (the left throttle disconnect switch is indicated by the red arrow).¹⁶⁵

12.1.1 Autoflight Go-Around Mode

A fully automatic go-around was only possible if accomplished prior to autopilot disconnect. The go-around (GA) mode was armed when the flaps were extended or the glideslope (G/S) was captured. Although arming the GA mode was not directly annunciated, the thrust limit changed to G/A when the GA mode was armed. The GA mode remained armed until 2 seconds after passing through 5 feet radar altitude (RA).

¹⁶⁵ Source: Photo taken of exemplar B-767 by NTSB investigators on February 27, 2019.

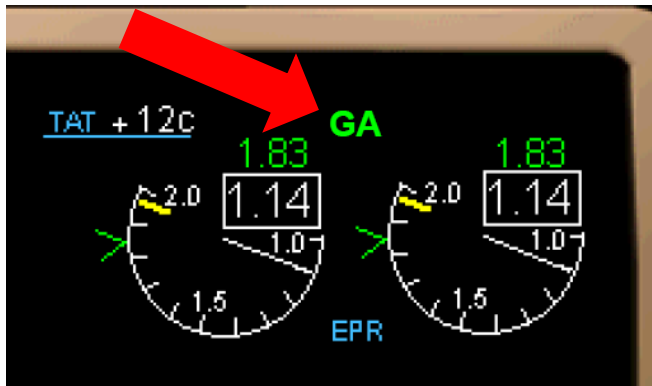


Figure 17: Go-around thrust limit annunciation on the EICAS (indicated by the red arrow).¹⁶⁶

As previously mentioned, about a minute before the accident the FDR recorded activation of the GA mode. The GA mode was engaged by pressing either of the go-around switches (left or right).



Photo 15: Photo of exemplar B-767 showing location of the go-around switches (the left go-around switch is indicated by the red circle).¹⁶⁷

When the GA was engaged, the AFDS controls pitch and roll while the A/T increased thrust to establish a 2,000 foot per minute climb. The FMA annunciations would be GA, GA, GA, CMD when an autopilot was engaged. The FMA annunciations would be GA, GA, GA, FD (flight director only) if the Flight Director was on and no autopilots were engaged.

¹⁶⁶ Source: Atlas Air 767 AFDS G-Around training module (CPaT.com Aviation Training Solutions).

¹⁶⁷ Source: Photo taken of exemplar B-767 by NTSB investigators on February 27, 2019.

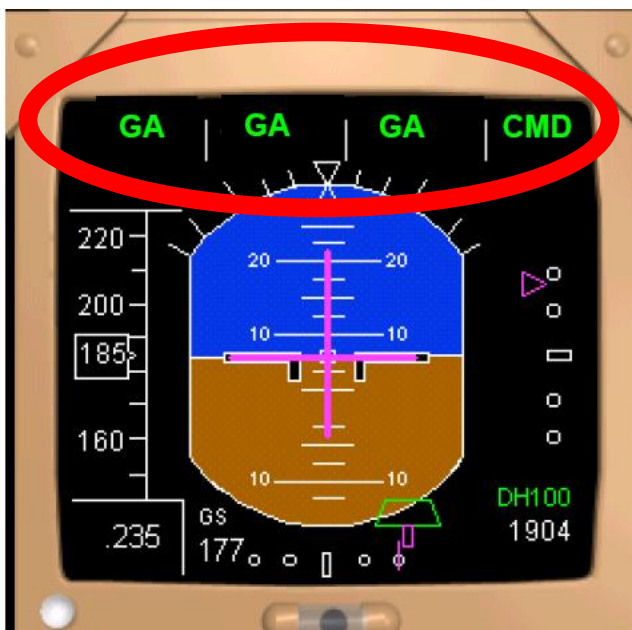


Figure 18: Go-around annunciations on the FMA (indicated by red circle).¹⁶⁸

The go-around A/T mode set thrust for a 2,000 feet per minute (fpm) climb. This power setting would likely be less than the GA thrust limit that was displayed above the N1 display on the EICAS. Therefore, excess thrust was normally available. If necessary, for windshear conditions, the pilot should not hesitate to disconnect the autothrottles and set power as required.

When a go-around was initiated, the commanded speed was the MCP IAS/MACH window or current airspeed, whichever was higher. If the airspeed increased and remained above the initial target airspeed for five seconds, target airspeed reset to current airspeed to a maximum of the IAS/MACH window speed plus 25 knots. If airspeed at initiation of go-around was greater than IAS/MACH window plus 25 knots, that speed was maintained.

The go-around procedure assumed that the MCP altitude was selected above the aircraft altitude at the time the go-around was initiated. Without a proper MCP altitude for the Missed Approach, the flight guidance will not automatically guide for an altitude capture.

According to the results from the June 5, 2019 Ops Group observation plan in a B-767 simulator at the Boeing Training and Professional Services facilities in Miami, Florida, a go-around on the autopilot with the MCP altitude set below the current airplane altitude would result in a continuous climb requiring resetting of the MCP altitude to a higher altitude or manual intervention to stop the climb.¹⁶⁹

¹⁶⁸ Source: Atlas Air 767 AFDS G-Around training module (CPaT.com Aviation Training Solutions).

¹⁶⁹ For additional information, see Attachment 31 - MIA B767 Simulator Observation.



Photo 16: Close-up of the B-767 go-around switches (the left go-around switch is indicated by the red arrow).¹⁷⁰

12.2 Weather Radar

According to the Atlas-Polar B-767 FCOM, Volume 2, page 11.20.10, the weather radar system consisted of a receiver-transmitter, an antenna, and a control panel. The control panel on the accident airplane was located on the left side of the aft aisle stand in the cockpit. Weather radar returns could be displayed on the captain and/or FO HSI, and display was controlled by a WXR weather radar switch on the EFIS control panel. The radar display range was set by the range selected on the EFIS control panel.

A WX/TURB mode switch allowed display of weather radar returns plus turbulence. Turbulence was only displayed within 40 nautical miles of the airplane when the range of the weather radar was selected at 40 miles or less. Turbulence detection required the presence of sufficient detectable precipitation, and would be displayed in magenta on the HSI. Clear air turbulence could not be detected by radar.

The Atlas-Southern FOM, page 8.1.34, stated the following in part:

Radar is a useful tool in determining areas of possible turbulence. Hooks, fingers, scalloped-edge echoes, or a rapid change in shape may be indicative of hail and severe turbulence. Such shapes may also be associated with tornadoes. Storms with radar returns showing steep rain gradients will produce severe turbulence.

The use of aggressive radar downtilt of 10° to 15° is a helpful technique to avoid operating too close to the top of a cell. This can be especially useful when operating in an area of rapidly developing cells.

¹⁷⁰ Source: Photo taken of exemplar B-767 by the NTSB investigators on February 27, 2019.

A predictive windshear alerting system used the weather radar to sense windshear. To provide windshear alerting, the weather transmitter was activated on the ground when takeoff power was set and in flight when the airplane was below 2,300 feet radio altitude. Weather radar returns were not displayed unless the WXR switch was ON, or a predictive windshear alert occurred.

12.3 Speedbrake Lever

The speedbrake lever on the B-767 allowed manual or automatic symmetric actuation of the spoilers. There were six spoiler panels located on the upper wing surface of each wing. Spoilers on opposing wings were symmetrically paired. The spoiler panels were used as speedbrakes to increase drag and reduce lift, both in flight and on the ground. The spoilers also supplemented roll control in response to control wheel commands.

The speedbrakes were controlled by the speedbrake lever on the control stand. The speedbrake had four marked positions:

- DOWN
- ARMED
- 50%
- UP

The armed position allowed the auto speedbrake to move the speed brake handle to UP and extend the spoiler panels on landing.

The B-767 aircraft with winglets installed had a speedbrake load alleviation system that operated in flight when the following conditions occur at the same time:

- Flaps were UP
- Gross weight was greater than 340,000 pounds
- Indicated airspeed was greater than 320 knots.

Load alleviation prevented the speedbrake from moving beyond the 50% position.

767 Aircraft with installed winglets

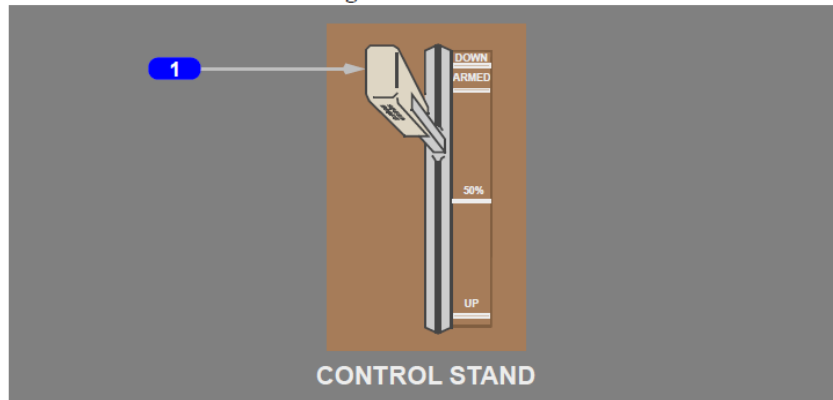


Figure 19: B-767 Speedbrake Lever (indicated by the number “1” in the figure).¹⁷¹



Photo 17: Photo of accident B-767 showing location of the speedbrake handle to the left of the thrust levers (the speedbrake handle is indicated by the red arrow).¹⁷²

According to the Atlas/Polar FCOM, Volume 1, page SMAC 70.1, the rate of descent depended on thrust, drag, airspeed schedule and gross weight. The approximate descent rates below 20,000 feet with idle thrust, FLAPS UP, clean or with speedbrakes were depicted in the follow table:

¹⁷¹ Source: Atlas/Polar B-767 FCOM Volume 2, page 9.10.9.

¹⁷² Source: Boeing March 24, 2019 email to the NTSB showing photos of N1217A following its conversion from passenger configuration to cargo configuration (date of photo unknown).

Target Speed	Typical Rates of Descent	
	Clean	With Speedbrakes
.78 Mach/290 knots	2000 fpm	4100 fpm
250 knots	1400 fpm	2900 fpm
VREF 30+80 knots	1100 fpm	2200 fpm

Figure 20: B-767 typical rates of descent table.¹⁷³

A note in the Atlas/Polar FCOM, Volume 1 stated that using speedbrakes to aid in the deceleration reduced these times and distances by approximately 30%.

The Atlas/Polar FCOM, Volume 1, page 70.5 stated the following in part:

The PF should keep a hand on the speedbrake lever when the speedbrakes are used in flight. This helps prevent leaving the speedbrake extended when no longer required.

Use of the speedbrakes does not appreciably affect aircraft roll response. While using the speedbrakes in descent or to reduce speed, allow sufficient altitude and airspeed margin to level off smoothly and retract the speedbrakes before adding thrust.

To avoid buffeting, use of the speedbrakes with flaps greater than 5 should be avoided. If circumstances dictate the use of speedbrakes with flaps extended, it is permissible; however, high sink rates during the approach should be avoided. Speedbrakes should be retracted before reaching 1000 feet AGL [above ground level].

When descending with the autopilot engaged and the speedbrakes extended at speeds near $V_{MO/MM}$,¹⁷⁴ the airspeed may momentarily increase to above $V_{MO/MMO}$ if the speedbrakes are retracted quickly. To avoid this, smoothly and slowly retract the speedbrakes to allow the autopilot sufficient time to adjust pitch to maintain airspeed within limits.

12.4 Stall Warning System

Warning of an impending stall was provided by left and right stick shakers, which independently vibrate the left and right control columns. If the flaps were in the retracted position and the angle of attack continued to increase, a control column nudger moved the control column forward. Both systems were energized in flight and deactivated on the ground through the air/ground logic.

¹⁷³ Source: Atlas/Polar B-767 FCOM, Volume 1, page SMAC.70.2.

¹⁷⁴ According to the Airplane Flying Handbook (FAA-H-8083-3B), Chapter 15, page 15-7, V_{MO} is the maximum operating speed expressed in terms of knots, and MMO is the maximum operating speed expressed in terms of decimal of Mach speed (speed of sound).

12.4.1 Stall Warning Cues

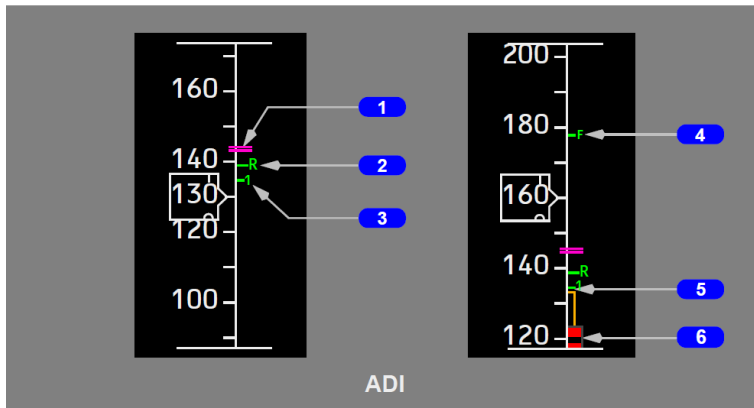


Figure 21: Airspeed cues as depicted in the Atlas/Polar FCOM.¹⁷⁵

Airspeed was displayed on a tape on the ADI, and included maximum and minimum airspeeds. The Minimum Maneuvering Speed was depicted as the top of the amber bar (indicated by the number “5” in Figure 20 above). This airspeed was displayed on the ADI shortly after takeoff and provided 1.3g maneuvering capability prior to stick shaker when the airplane was below 20,000 feet, or 1.3g maneuvering capability prior to low speed buffet (or an alternative approved maneuver capability as preset by maintenance) above approximately 20,000 feet. The 1.3g maneuvering capability occurred at 40 degrees of bank in level flight.

The Minimum Operating Speed was depicted as the top of the “barber pole” (indicator “6” in Figure 20 above). This airspeed indicated the minimum operating speed where the stick shaker activates when the airplane was below 20,000 feet, or the airspeed where the stick shaker or low speed buffet occurred (whichever was higher) when the airplane was above 20,000 feet.

A speed Trend Vector was also displayed on the speed tape to indicate predicted airspeed in 10 seconds based on current acceleration or deceleration.

In addition, an amber Pitch Limit Indicator (PLI) could be displayed on the ADI when the flaps were extended. The position of the pitch limit indicator was a function of the stall warning computer. It was programmed so that stick shaker activation would coincide with the pitch attitude equal to the pitch limit indication.¹⁷⁶

¹⁷⁵ Source: Atlas/Polar FCOM, Volume 2, page 10.10.19.

¹⁷⁶ Source: Atlas/Polar FCOM Volume 2, page 10.20.4.

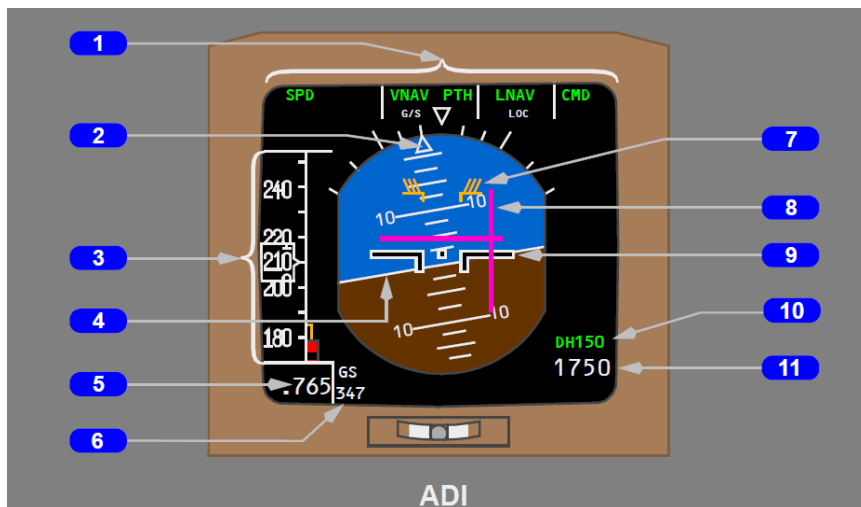


Figure 22: Pitch Limit Indicator (PLI) displayed on the ADI (indicated by the number “7” in the figure).¹⁷⁷

The B-767 was also equipped with two electric mach/airspeed indicators that displayed airspeed, Mach and V_{MO} from the selected air data source.



Figure 23: B-767 cockpit layout with location of conventional airspeed indicators (indicated by red boxes).

The V_{MO} pointer indicated the maximum operating airspeed in knots or the equivalent to the maximum operating mach number. The command airspeed bug on each indicator could be automatically positioned from the FMC, or manually from the MCP IAS/MACH selector on the MCP.

¹⁷⁷ Source: Atlas/Polar FCOM Volume 2, page 10.10.12.



Photo 18: Photo of FO's conventional airspeed indicator on the accident airplane (the VMO pointer is indicated by the red arrow)..¹⁷⁸

13.0 Atlas Air Automation Policy

The Atlas Air Automation Policy was defined in the Atlas-Southern FOM, page 10.1.3. According to the FOM, automation was provided to enhance safety, maximize efficiency, reduce crewmember workload, and improve operational capabilities. Crewmembers should use the available automation at the level most appropriate to achieve these objectives. A note in the FOM stated the following:

*At least one pilot should maintain outside visual awareness.*¹⁷⁹

The FOM also included a section for Automation Management, page 11.1.29, and stated in part:

Proper automation management relates to situational and/or workload requirements. A pilot's mastery of flight modes, FMC and MCP inputs toward flight path management is a necessary tool to improve safety and balance workload. However, overuse of autoflight systems may lead to a degradation of the pilot's (and in the end the overall crew's) ability to quickly recover from an Undesired Aircraft State (UAS).

Automation Rules of Thumb

- *Immediate maneuvering is required: reduce the level of automation*

¹⁷⁸ Source: Boeing March 24, 2019 email to the NTSB showing photos of N1217A following its conversion from passenger configuration to cargo configuration (date of photo unknown).

¹⁷⁹ Source: Atlas-Southern FOM, page 10.1.3.

- *Automation is the problem: reduce the level of automation*
- *Workload increases (an automation is not the problem): increase the level of automation*

The PF will clearly communicate the level of intended automation. The PM must alert PF of a hinderance the proposed level of automation may have on flight path monitoring and/or crew workload. An acceptable resolution must follow.¹⁸⁰

14.0 Relevant Procedures

14.1 Atlas Air B-767 Stall Recovery Procedures

According to the Atlas-Polar B-767 FCOM, Volume 1, a stall warning was considered to be any warning readily identifiable to the pilot (e.g. stick shaker, initial buffet).¹⁸¹ Any of the following indications should be considered to be such a warning:

- Stick shaker
- Stall warning
- Initial buffet
- Rapid decrease of airspeed below V₂ during takeoff or V_{REF} during landing/go-around

According to the Atlas-Polar B-767 FCOM, a characteristic unique to airplanes with under-wing-mounted engines was a nose-up or nose-down pitch tendency when thrust was increased or reduced. Adding excessive amounts of thrust may cause a pitch-up moment that may be difficult for the elevator to counteract at lower speeds.

The approach to stall or stall recovery maneuver called for the crew to advance the thrust levers as needed. Under certain conditions, where high thrust settings were already applied such as during takeoff or go-around, it may be necessary to reduce thrust in order to prevent the angle of attack from continuing to increase.

With flaps extended, stall warning was indicated by stick shaker and initial buffet. Under most conditions stick shaker preceded buffet onset, but either should be considered indication of approaching stall regardless of which occurred first.

For any airspeed, the angle of attack was greater with the speedbrakes extended, which increased initial buffet speed and stick shaker speed but had a lesser effect on actual stall speed. The aircraft exhibited no unusual flight characteristics during stall warning or recovery. Response to control inputs was immediate and positive.

¹⁸⁰ Atlas-Southern FOM , page 11.1.29.

¹⁸¹ The Airplane Flying Handbook (FAA-H-8083-3A), page 1-6 stated the following in part: *The key to stall awareness is the pilot's ability to visualize the wing's angle of attack in any particular circumstance, and thereby be able to estimate his/her margin of safety above a stall. This is a learned skill that must be acquired early in flight training and carried through the pilot's entire flying career. . . It is essential to flight safety that a pilot take into consideration this visualization of the wing's angle of attack prior to entering any flight maneuver.*

According to the Atlas-Polar 767 FCOM, Volume 1, page SMAC.131.2, recovery from approaches to stalls were required to be performed at the first indication of a stall. Recovery from low altitude stalls required the following actions:

- *Simultaneously disengage the autopilot, push either autothrottle disengage switch, and advance the thrust levers as needed to accelerate.*
- *Adjust pitch, roll in the shortest direction to wings level, if needed, and retract the speedbrakes.*
- *A pitch attitude which results in intermittent stick shaker or initial aerodynamic buffet is the upper pitch attitude limit. Avoid abrupt control inputs as they may induce a secondary stall. Adjust pitch as necessary to stay out of stick shaker.*
- *If stick shaker is encountered, adjust the pitch attitude downward in small increments until the stall warning stops. Do not fly in stick shaker as a rapid loss of lift occurs as stall speed is approached.*
- *Abnormal control forces may be experienced. Nose down stabilizer trim may be needed.*
- *The pitch limit indicator indicates the attitude at which stick shaker activates, and may be used as a maximum pitch reference during the maneuver. It should not be used as a pitch command.*
- *The PM should monitor and call out the vertical flight path indications (vertical speed, altimeter, radio altimeter) to assist the PF in returning the aircraft to a positive rate of climb.*
- *Maintain flap and landing gear position until out of the stall.*
- *When terrain/obstacle clearance is assured, adjust thrust and resume normal speed and configuration.*¹⁸²

According to the Atlas-Polar B-767 FCOM, Volume 1, a fully developed stall must not be confused with the stall warning that warns of an approaching stall. The FCOM further stated that recovery from an approach to a stall was different than recovery from a fully developed stall.

In a fully developed stall, the autopilot should be disengaged and the autothrottle disengaged. To recover from a fully developed stall, angle of attack must be reduced below the stalling angle by applying nose-down pitch control and maintaining it until wings were no longer stalled.

Application of as much as full forward control column and use of some nose-down stabilizer trim should provide sufficient elevator control to produce a nose-down pitch rate.

According to the Atlas-Polar B-767 FCOM, Volume 1, all recoveries from approach to stall should be done as if an actual stall has occurred, and pilots were required to accomplish the following at the first indication of a stall (buffet or stick shaker).

¹⁸² Source: Atlas-Polar B-767 FCOM, Volume 1, page SMAC.131.3.

PF	PM
Initiate the recovery: <ul style="list-style-type: none"> • Hold the control column firmly. • Disengage autopilot and autothrottle. • Smoothly apply nose down elevator to reduce the angle of attack until buffet or stick shaker stops. Nose down stabilizer trim may be needed.* 	<ul style="list-style-type: none"> • Monitor altitude and airspeed. • Verify all required actions have been done and call out any omissions. • Call out any trend toward terrain contact.
Continue the recovery: <ul style="list-style-type: none"> • Roll in the shortest direction to wings level if needed.** • Advance thrust levers as needed. • Retract the speedbrakes. • Do not change gear or flap configuration, except during liftoff if flaps are up, call for flaps 1. 	<ul style="list-style-type: none"> • Monitor altitude and airspeed. • Verify all required actions have been done and call out any omissions. • Call out any trend toward terrain contact. • Set the FLAP lever as directed.
Complete the recovery: <ul style="list-style-type: none"> • Check airspeed and adjust thrust as needed. • Establish pitch attitude. • Return to the desired flight path. • Re-engage the autopilot and autothrottle if desired. 	<ul style="list-style-type: none"> • Monitor altitude and airspeed. • Verify all required actions have been done and call out any omissions. • Call out any trend toward terrain contact.

WARNING: *If the control column does not provide the needed response, stabilizer trim may be necessary. Excessive use of pitch trim may aggravate the condition, or may result in loss of control or in high structural loads.

Figure 24: Atlas Air B-767 Stall Recovery Procedures.¹⁸³

On June 5, 2019 the NTSB conducted an observation plan in a B-767 simulator at the Boeing Training and Professional Services facilities in Miami, Florida, and Atlas Air stall recovery procedures were documented. For additional information, see Attachment 31 - Simulator Observation.

14.2 Atlas Air B-767 Upset Recovery Procedures¹⁸⁴

According to the Atlas-Polar FCOM B-767 Volume 1, an upset was an inadvertent aircraft attitude occurring as a result of such things as turbulence, instrument failure, distraction, spatial disorientation, or transition from visual meteorological conditions (VMC) to instrument

¹⁸³ Source: Atlas-Polar B-767 FCOM, Volume 1, page SMAC.131.5. A note in the FCOM directed pilots not to use the flight director commands during the recovery. For additional information, see Attachment 27 - Atlas Air Stall Recovery Guidance.

¹⁸⁴ Source: Atlas Air B-767 FCOM, Volume 1. For additional information, see Attachment 28 - Atlas Air Upset Recovery Guidance.

meteorological conditions (IMC). An upset could generally be defined as unintentionally exceeding any of the following conditions:

- Pitch attitude greater than 25° nose up.
- Pitch attitude greater than 10° nose down.
- Bank angle greater than 45°.
- Within above parameters but at an airspeed inappropriate for conditions.¹⁸⁵

In most cases, upsets were mild enough that reestablishing the proper attitude for the desired flight condition and resuming a normal instrument scan will ensure recovery. In all cases, however, successful recoveries were based on a distinct pattern of actions – recognize, confirm, and recover.

Top priority should be given to early recognition and rapid correction of attitude excursions. It was important to transition to instrument references any time disorientation occurs or outside visual references became unreliable.

The recovery techniques used must be compatible with the severity of the upset, the characteristics of the aircraft, and the altitude available for recovery.

An upset was recognized by an unexpected presentation on the attitude display and/or conflicting indications on the performance instruments (airspeed display, vertical speed display, altitude display, etc.) Regardless of how the upset was recognized, the pilot must verify that an upset had occurred by comparing control and performance instrument indications prior to initiating the recovery on the attitude display. This was to prevent aggravating the upset as a result of making control movements based on erroneous instrument indications.

During the recognition process, the attitude must be correctly interpreted by cross-check other indicating sources (e.g. other pilot's attitude display, standby attitude indicator) to determine if an attitude display failure might be the cause. With an inoperative attitude display, early recognition of failure was critical because spatial disorientation may become severe. Therefore, it was essential that the PF's attention be directed toward an operative attitude display while cross-checking the performance instruments during recovery.¹⁸⁶

¹⁸⁵ According to the Airplane Upset Recovery Training Aid, Revision 2 dated November 2008, this list from the Atlas-Polar FCOM B-767 Volume 1 is identical to the definition of an airplane upset in the Training Aid. In addition, the Training Aid stated "an airplane is stalled when the angle of attack is beyond the stalling angle. A stall is characterized by any of, or a combination of, the following: a. Buffeting, which could be heavy at times, b. A lack of pitch control, c. A lack of roll control, d. Inability to arrest descent rate."

¹⁸⁶ The Airplane Upset Recovery Training Aid, Revision 2 dated November 2008, page 2.44, stated the following in part: *"In most cases effective situational awareness will avoid an upset from developing in the first place. However, it is important that the first actions for recovering from an airplane upset be correct and timely. Exaggerated control inputs through reflex responses must be avoided. It is worth repeating that inappropriate control inputs during one upset recovery can lead to a different upset situation. Troubleshooting the cause of the upset is secondary to initiating the recovery. However, the pilot still must recognize and confirm the situation before a recovery can be initiated. Regaining and then maintaining control of the airplane is paramount. Communicating between crew members will assist in the recovery actions. At the first indication of an unusual occurrence, the pilot should announce what is being observed."*

According to the Atlas-Polar B-767 FCOM, Volume 1, all pilots were required to use the following procedures to recover from upset:

Upset Recovery Procedure

Nose High Recovery

PF	PM
Recognize and confirm developing the situation.	
<p>Immediately and simultaneously:</p> <ul style="list-style-type: none"> • Disengage the autopilot. • Disengage the autothrottle. <p>Recover:</p> <ul style="list-style-type: none"> • Apply nose-down elevator. Apply as much elevator as needed to obtain a nose down pitch rate. • Apply appropriate nose down stabilizer trim.* • Reduce thrust. • Roll (adjust bank angle) to obtain a nose down pitch rate.* <p>Complete the recovery:</p> <ul style="list-style-type: none"> • When approaching the horizon, roll to wings level. • Check airspeed and adjust thrust. • Establish pitch attitude. 	<p>Call out attitude, airspeed and altitude throughout the recovery.</p> <p>Verify all needed actions have been done and call out any continued deviation.</p>

WARNING: *Excessive use of pitch trim or rudder can aggravate an upset, result in loss of control, or result in high structural loads.

Figure 25: Atlas Air Nose High Upset Recovery Procedure.¹⁸⁷

¹⁸⁷ Source: Atlas Air B-767 FCOM, Volume 1, page SMAC.132.6. In addition, The Airplane Upset Recovery Training Aid, Revision 2 dated November 2008, page 2.48, stated the following in part for a nose-high, wings level recovery technique: Recognize and confirm the situation; disengage the autopilot and autothrottle; apply as much as full nose-down elevator; use appropriate techniques)roll to obtain a nose-down pitch rate, reduce thrust for underwing-mounted engines; complete recovery (approaching horizon, roll to wings level, check airspeed and adjust thrust, establish pitch attitude.

Nose Low Recovery

PF	PM
Recognize and confirm the developing the situation.	
Disconnect autopilot. Disconnect autothrottle. Recover: <ul style="list-style-type: none">• Recover from stall, if needed• Roll in the shortest direction to wings level. If bank angle is more than 90 degrees, unload and roll* Complete the recovery: <ul style="list-style-type: none">• Apply nose up elevator• Apply nose up trim, if needed*• Adjust thrust and drag, if needed	Call out attitude, airspeed and altitude throughout the recovery. Verify all needed actions have been done and call out any continued deviation.

WARNING: *Excessive use of pitch trim or rudder can aggravate an upset, result in loss of control, or result in high structural loads.

Figure 26: Atlas Air Nose Low Upset Recovery Procedure.¹⁸⁸

14.3 Atlas Air B-767 Turbulence Procedures

According to the Atlas-Polar FCOM B-767 Volume 1, page SP.16.31, in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless performance is not desirable. Increased thrust lever activity and brief airspeed excursions of 10 to 15 knots can be expected if large wind, temperature, and pressure changes occur.

When the aircraft was operated at its optimum altitude based on weight, buffet boundary margins will normally be greater than 0.5g. According to the FCOM, because of this, buffet and control margins were adequate for most conditions.

The turbulent air penetration speed for the B-767 was 290 knots/.78 Mach. Below 10,000 feet, a speed of 240 and 250 knots provided adequate buffet margin. If severe turbulence was encountered below 15,000 and gross weight was less than the maximum landing weight, the airplane may be slowed to 250 knots in the clean configuration. Adequate stall margin existed under these conditions.¹⁸⁹

14.4 Atlas Air B-767 Go-around Procedures

According to the Alas-Polar FCOM, Volume 1, page SMAC.100.1, the go-around and missed approach was generally performed in the same manner whether an instrument or visual approach was flown. Procedurally, if a go-around was required, the following were to be performed:

¹⁸⁸ Source: Atlas Air B-767 FCOM, Volume 1, page SMAC.132.7.

¹⁸⁹ Source: Atlas Air B-767 FCOM, Volume 1. For additional information, see Attachment 29 - Atlas Air Turbulence Guidance.

- Simultaneously apply go-around thrust and push either GA switch. If an autopilot is engaged, the aircraft will rotate to go-around pitch attitude. If an autopilot is not engaged, rotate smoothly toward a 15° pitch attitude.
- If a go-around is initiated with the autopilot disengaged, push the GA switch. If the GA switch is not pushed, the flight directors remain in the approach mode.
- Retract flaps to 20.
- When both the altimeter and vertical speed displays indicate a positive rate of climb, and airspeed is above V_{REF} ,¹⁹⁰ retract the landing gear.
- Ensure go-around thrust for the nominal climb rate is set and monitor autopilot performance.
- Ensure missed approach altitude is set in the MCP ALT window
- After reaching a safe altitude (above 400 feet HAA) and as required by procedure or ATC, call for LNAV or HDG SEL.
- When climbing through acceleration height, accelerate to flap retraction speed by repositioning the command speed to maneuvering speed for the desired flap setting
- Verify acceleration and retract flaps on schedule.

According to the FCOM, at typical landing weights, actual thrust required for a normal go-around was usually considerably less than maximum go-around thrust. This provided a thrust margin for windshear or other situations requiring maximum thrust. If full thrust was desired after thrust for the nominal climb rate had been established, the pilot should advance the thrust levers manually to maximum go-around thrust.

Specific go-around procedures for the B-767 was found in the Atlas-Polar B-767 FCOM, Volume 1, page NP.55.1. The Atlas-Polar B-767 FCOM, Volume 1 did not have specific procedures for the inadvertent selection of a go-around switch.

Atlas Air had a “no-fault” go-around policy defined in the Atlas-Southern FOM. The FOM, page 10.1.17, stated the following, in part:

Any and all go-arounds are no-fault.

Regardless of the reason for a go-around, any flight crewmember can call for a Go-Around and the PF must honor/execute a go-around. If mechanical problem/configuration warning caused the missed approach/go-around/rejected landing, make an Aircraft Log entry.

Regardless of the reason for the Go-Around, the submission of an ASAP is encouraged.

¹⁹⁰ V_{REF} is defined as 1.3 times the stalling speed in the landing configuration (VSO). It is the required speed at the 50-foot height above the threshold end of the runway. Source: Pilot’s Handbook of Aeronautical Knowledge, FAA-H-8083-25A, Chapter 10, page 10-32.

Normal Procedures
Go-Around
Chapter NP
Section 55
Go-Around Procedure

PF	PM
Push GA switch.	Position flaps as directed.
Call "GO-AROUND, FLAPS 20".	Check for proper flap indications.
Verify rotation to go-around attitude and thrust increase.	
	Verify thrust adequate for go-around. Adjust thrust if necessary.
When both the altimeter and vertical speed displays show a positive rate of climb, and airspeed above VREF:	
Call "GEAR UP".	Call "POSITIVE CLIMB".
	Retract the landing gear. Check for proper landing indications. Verify/set missed approach altitude.
At or above 400 feet RA:	
Command/select LNAV or HDG select.	Select commanded roll mode.
At acceleration height (normally 1,000 feet AFE):	
Command/set speed to the maneuver speed for the planned flap setting. Call "FLAPS ____" on schedule.	Select speed as commanded by the PF Repeat the command and position FLAP handle as directed. Check for proper flap indications.
If another approach is warranted at the destination airport	
Consider leaving flaps at 5 and maintain appropriate maneuvering speed.	Verify flaps 5 and appropriate maneuvering speed as directed.

Figure 27: Atlas Air B-767 go-around procedures.¹⁹¹¹⁹¹ Source: Atlas-Polar B-767 FCOM, Volume 1, pages NP.55.1 and NP.55.2.

Atlas-Polar 767 FCOM Volume 1

PF	PM
After planned flaps set and above flap maneuvering speed:	
Command/select FLCH or VNAV. Call "CLIMB THRUST" (two engines). Call "MAX CONTINUOUS THRUST" (single engine).	Select commanded pitch mode. Select CLB Thrust/MCT, as applicable. After thrust is set and the landing gear display is normal, position landing gear handle to OFF
Call "___ AUTOPILOT COMMAND" if desired.	Engage autopilot at the command of the PF.
Verify missed approach route being tracked and missed approach altitude captured.	
Call "AFTER TAKEOFF CHECKLIST".	Read AFTER TAKEOFF checklist.

Figure 28: Atlas Air B-767 go-around procedures (continued).

On June 5, 2019 the Ops Group conducted an observation plan in a B-767 simulator at the Boeing Training and Professional Services facilities in Miami, Florida. Atlas Air go-around procedures and captain and FO arm positions relative to the go-around switches were documented. For additional information, see Attachment 31 – MIA B767 Simulator Observation.

As part of the investigation, the NTSB requested data from the National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS)¹⁹² regarding a history of reports for inadvertent selection of the go-around switch on the B-767 series aircraft. For additional information, see Attachment 24 - ASRS Request SR7290.

15.0 FAA Oversight¹⁹³

The Atlas Air Inc. Certificate Management Team (CMT) was part of the DFW (Dallas-Ft. Worth) Certificate Management Office (CMO), SW-07. The three Principal Inspectors were located within the Cincinnati Flight Standards District Office (FSDO) as were a number of the CMT's Aviation Safety Inspectors (ASIs). Inspectors based there were mainly airworthiness (AW) inspectors assigned to the certificate, but that also included the Operations (Ops) Front Line Manager (FLM), and one unit Aviation Safety Assistant. The remaining ASIs were remotely sited across the United States, including New York, Connecticut, California, Ohio, Indiana, New Jersey, and Texas. The AW FLM was based in Texas, as were the remaining administrative support staff for the CMT, including the CMO Manager and Assistant Manager.

The CMT had FAA oversight responsibility for three 14 *CFR* Part 121 Air Carriers: Atlas Air Inc. (UIEA), Polar Air Cargo LLC (P5CA), and Southern Air Inc. (Q2SA). Atlas Air and Southern Air were in the process of an OpSpec A502 (Air Carrier Mergers and/or Acquisitions) merger,

¹⁹² The ASRS collects voluntarily submitted aviation safety incident/situation reports from pilots, controllers, and others.

¹⁹³ Source: Email from the FAA to the NTSB, received October 21, 2019 10:28 AM. See Attachment 17 - FAA Interview Summaries.

with Atlas Air ultimately being the surviving carrier. This merger began in January 2017 and currently has an anticipated Single Operating Certificate (SOC) date of 31 August 2020. The Polar certificate was not involved in the merger and will remain as a separate entity. All three carriers were owned by a single parent company, Atlas Air Worldwide Holdings. These were three separate carriers, each with their own 14 *CFR* part 119 management structures, Safety Assurance System (SAS) program, Aviation Safety Action Programs (ASAP) programs, and OpSpecs. Due to the merger and past practices of previous CMTs, the manual systems were both separate and intermingled, with Atlas, Polar, Southern, Atlas-Polar, Atlas-Southern, and Atlas-Polar-Southern manuals being the result.

At the time of the Atlas Air Flight 3591 accident, the Ops side of the CMT consisted of the Principal Operations Inspector (POI) assigned oversight of all three carriers; a B-747 Aircrew Program Manager (APM) and Assistant Aircrew Program Manager (AAPM); and a B-767 APM and AAPM assigned to the Atlas Air certificate. In addition, there was a B-737 and a B-777 APM for Southern, an ASAP Manager (who is assigned to all three certificates), and one Geographic Ops Inspector. There was also a Cabin Safety Inspector (CSI) and a Dispatch Safety Inspector (DSI) assigned to the CMT as shared resources with other carriers. Starting in August of 2019, two Assistant Principal Operations Inspectors (APOIs) and one additional Geographic Ops Inspector had been added to the certificate.

Oversight was conducted utilizing the Safety Assurance System (SAS); the Flight Standards Information Management System (FSIMS), consisting of FAA Order 8900.1; FAA Notices, bulletins, ADs, Advisory Circulars, etc. Assignments for surveillance were contained in the SAS, with recommendations for Inspector assignment and Instructions provided by the Principal Inspectors. The actual work assignments were the responsibility of the FLMs. A review of the surveillance results by the Principals created surveillance assignments and areas of added surveillance based upon the risks uncovered during the Inspections as well as any risks discovered by other means such as ASAP, VDRPs, and Hotline Complaints. Additional surveillance may be indicated by these inputs and put forth by the Principal Inspectors.

When asked about his involvement in the PRIA process at Atlas Air, the POI said his involvement as the POI with an Operator like Atlas Air was limited outside of the certification phase, which would consist of verifying that a number of required processes and procedures were in place for the satisfactory conduct of the PRIA program by the carrier. This process was outlined in AC 120-68H with PRIA Guidance for FAA Inspectors found in the FAA's Order 8000.8. The latter included a PRIA Air Carrier Basic Compliance Checklist.

The Atlas Air POI was present at a 2016 Atlas Air check pilot group meeting where lack of experienced pilots for the company and industry in the near future was discussed. The lack of experience in larger aircraft and the need for additional training following unsatisfactory check rides had also increased at Atlas Air, along with additional time spent in OE for new hires. According to the POI, he had not heard of any issues with a lowering of performance standards at Atlas Air, or that those who did pass their check rides did not meet FAA standards.

The POI also stated that Atlas Air had suffered a loss of pilots to other operators with more attractive pay scales and benefit packages, but had no definitive data correlating incidents in the aircraft to low experience or lack of proficiency.

F. LIST OF ATTACHMENTS

Attachment 1 - Atlas Air Interview Transcripts
Attachment 2 - Records of Conversation
Attachment 3 - Atlas Air Flight 3591 Flight Release
Attachment 4 - Weight and Balance Information
Attachment 5 - Atlas Air 3591 Cargo Loader Information
Attachment 6 - StratAir Employee Statements
Attachment 7 - National Airport Services (NAS) Employee Statements
Attachment 8 - Atlas Air Flight 3591 ACARS Messages
Attachment 9 - Captain Information
Attachment 10 - First Officer Information
Attachment 11 - Atlas Training Records - Captain
Attachment 12 - Atlas Training Records - First Officer
Attachment 13 - Crew Schedules
Attachment 14 - Captain PRIA Documentation
Attachment 15 - First Officer PRIA Documentation
Attachment 16 - Flight Crew's Resumes and Atlas Applications
Attachment 17 - FAA Interview Summaries
Attachment 18 - AC 120-68H PRIA
Attachment 19 - Atlas Air Pilot Interview Process
Attachment 20 - Atlas Air PWP Program (FOTM Revision)
Attachment 21 - Flight Crew 72-hour History Documents
Attachment 22 - Atlas CRM Training Presentation
Attachment 23 - Atlas Air Operational Safety and Crew Concepts
Attachment 24 - ASRS Request SR7290
Attachment 25 - Other Pilot Statements
Attachment 26 - Witness Statements
Attachment 27 - Atlas Air Stall Recovery Guidance
Attachment 28 - Atlas Air Upset Recovery Guidance
Attachment 29 - Atlas Air Turbulence Guidance
Attachment 30 - Atlas Air GPWS Guidance
Attachment 31 - MIA B767 Simulator Observation
Attachment 32 - Party Forms
Attachment 33 - Subpoenas

Submitted by:

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